EP 11 1997

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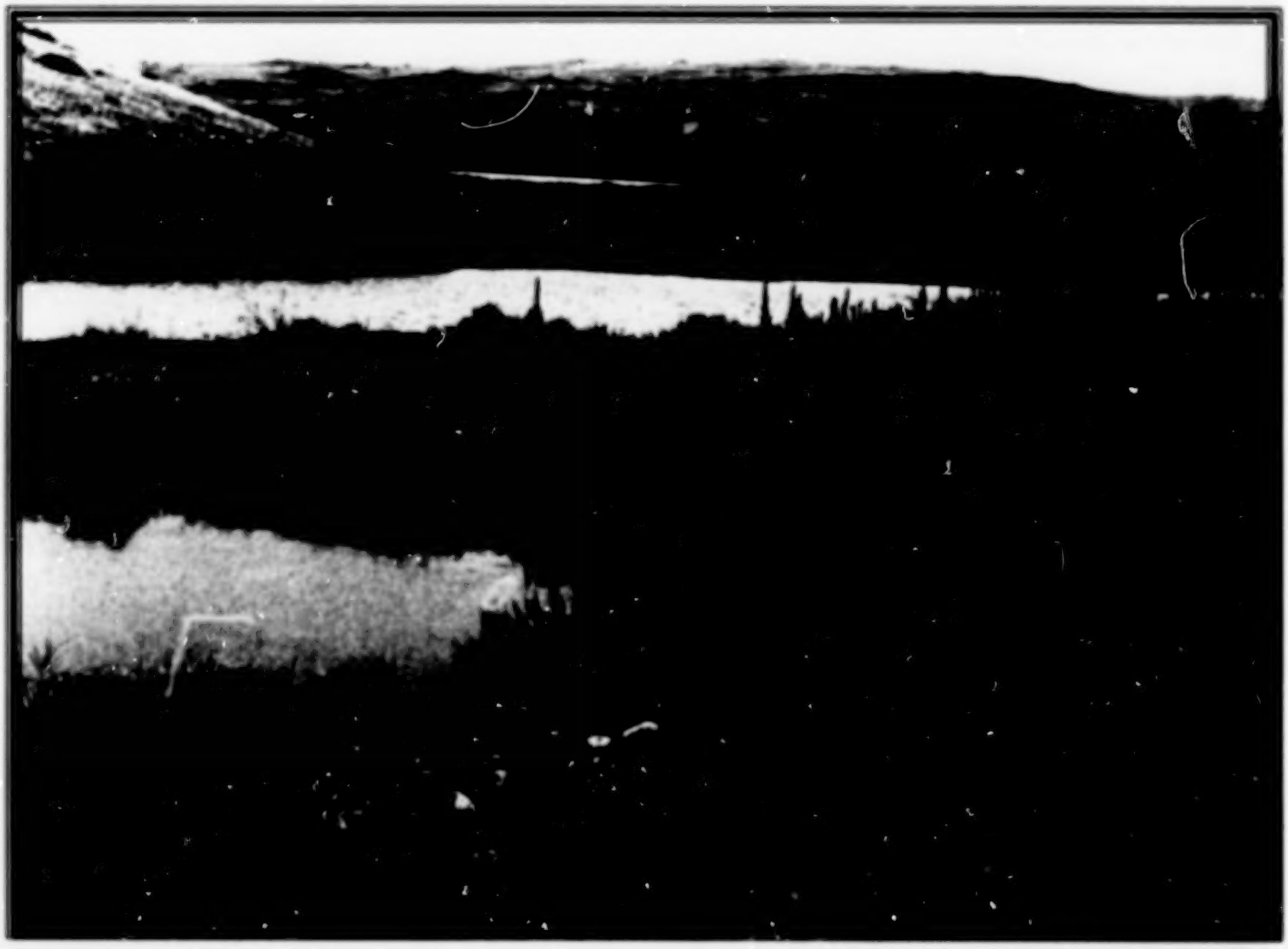
U.S. Department of the Interior
Bureau of Land Management
Casper District Office

Buffalo Resource Area August 1997

FINAL
Gillette South Coal Bed Methane Project Environmental Impact Statement



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The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield; a combination of uses that take into account the long term needs of future generations for renewable and nonrenewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness and natural, scenic, scientific and cultural values.

BLM/WY/PL-97/016+1320

FEIS 97-24

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

August 1997

Dear Reader:

This Final Environmental Impact Statement (FEIS) on the proposed Gillette South Coal Bed Methane Project is submitted for your review and comment. As a supplement to the draft EIS published in March 1997, this volume contains some additional information and an "Errata" section. An expanded Consultation and Coordination section (Chapter 5) to include the comment letters received on the draft EIS and responses to those comments is also included in this document.

Because this is an abbreviated final, this document and the draft EIS comprise the entire document for filing purposes and for the decision making process. Please refer to this document for a more detailed analysis and description of the proposed action and alternatives.

Written comments will be considered in the decision if they are received within 30 days of the Environmental Protection Agency's (EPA) Federal Register publication of the Notice of Availability of the FEIS. Copies of the FEIS may be obtained upon request from the Bureau of Land Management, Casper District Office, 1701 East "E" Street, Casper, WY 82601, (307) 261-7600; Bureau of Land Management, Buffalo Resource Area, 1425 Fort Street, Buffalo, WY 82834, (307) 684-1100; or Bureau of Land Management, Wyoming State Office, 5353 Yellowstone Rd., Cheyenne, WY 82009, (307) 775-6256.

This FEIS is not the decision document. The decision on the proposed gas development and associated rights-of-way will be based on the analysis in the draft and final EISs, public concerns and comments, and other multiple-use resource objectives or programs that apply to the project. A Record of Decision (ROD) detailing the decision of the BLM and its rationale for the decision will be prepared and distributed following the end of the 30-day review period. Presently the ROD is anticipated to be available for release in October 1997.

Comments on the content of this FEIS should be sent to:

Richard Zander, Assistant Area Manager
Bureau of Land Management
Buffalo Resource Area
1425 Fort Street
Buffalo, WY 82834

The BLM appreciates the individuals, organizations, Federal, State, and local governments who participated in the environmental analysis process. Your involvement has enhanced the integrity of the EIS and the public land manager's ability to make an informed decision.

Sincerely,

Jerry Jensen
for Alan R. Pierson
State Director

Attachment

GILLETTE SOUTH
COAL BED METHANE PROJECT

FINAL ENVIRONMENTAL IMPACT STATEMENT

Prepared by:

United States Department of the Interior
Bureau of Land Management
Buffalo Resource Area
Casper District
Casper, Wyoming

Jerry Jessen
State Director
Acting

August 1997

III

CHAPTER 1

PURPOSE OF, AND NEED FOR, THE PROPOSED ACTION

INTRODUCTION

This document has been prepared as an abbreviated final environmental impact statement (EIS). It must been used in concert with the draft EIS to understand the analysis which includes the responses to comment letters. It is organized by chapters, the same as the draft EIS, but only changes (errata) or new information or analysis is included. Most of these were generated in response to public comments. The largest section of the document is chapter 5, Consultation and Coordination. It includes an update on what coordination has taken place since the draft EIS was issued, responses to comments, and all comment letters. All comments were taken into consideration in the preparation of this document; however, those containing only opinions or preferences did not receive a formal response.

PURPOSE AND NEED

The operators propose to develop the coal bed methane (CBM) within the assessment area by increasing the total number of wells and ancillary facilities where economically feasible. This proposal would enhance recovery of the methane from the assessment area, thus allowing all operators to provide more gas to companies distributing and supplying methane to consumers by making gas supplies available.

The development of federal oil and gas leases is an integral part of the Bureau of Land Management's (BLM) oil and gas leasing program under authority of the Mineral Leasing Act of 1920, as amended, the Federal Land Policy and Management Act of 1976 (FLPMA), as amended, and the Federal Onshore Oil and Gas Leasing Reform Act of 1987. The BLM's Buffalo Resource Area resource management plan (RMP) (USDI, BLM 1985) reviewed all public lands in the project area and determined them to be suitable for oil and gas leasing and development, subject to certain stipulations.

The purpose of, and need for, the proposed coal bed methane development is to exercise the leaseholders' rights within the project area to drill for, extract, remove, and market coal bed methane. Also included is the right of the area leaseholders to build and maintain necessary improvements, subject to renewal or extension of the lease or leases in accordance with the appropriate authority.

ERRATA

On page 4, under "Authorizing Actions," first paragraph, line 4 should read, "...state, and federal laws. Before a well can be drilled on federal minerals,...."

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CHAPTER 2

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter has been reprinted in its entirety and includes minor changes in response to comments.

INTRODUCTION

A total of six alternatives are considered in this EIS. The first, the Proposed Action, considered that a total of 400 wells (210 private or state and 190 federal) would be approved and drilled over approximately a three- to five-year period. The other five alternatives are: 1) to restrict the rate at which federal wells are approved; 2) to reduce the number of federal wells approved; 3) to change the method of disposal of water on the land surface; 4) to consider underground injection of the produced water; and, 5) to reject all applications for federal wells (No Action).

THE PROPOSED ACTION

The Proposed Action consists of drilling, completing, and operating approximately 400 CBM wells in the eastern Powder River Basin of central Campbell County, Wyoming. Of these wells, a maximum of 190 would be located on lands where the oil and gas minerals are owned by the federal government (41% of the project area). These wells would be drilled by several companies over a three- to five-year period. Development would depend on the ability to compress and market the methane. Each well's application for permit to drill (APD) would be reviewed and approved on a case-by-case basis. This would allow conditions of approval to be developed for the CBM wells on the basis of monitoring.

In addition to the new 400 proposed wells, the Proposed Action also analyzes the increased rate of development, the increased rate of production, the increased surface water discharge, and the increased area of disturbance from the Lighthouse (200 wells) and Marquiss (40 wells) environmental assessments (EAs).

The CBM wells would be located from 1 mile south of Gillette to 12 miles south of Wright, Wyoming. As stated under the "Location of the Proposed Action" in chapter 1 of the draft EIS, the project boundary is delineated by industry interest; there is no legal requirement for companies to confine drilling to this area other than their federal oil and gas leases. Even without BLM approval, the majority of private- and state-owned gas would be developed, but under the Proposed Action the project would include production from private, state, and federal oil and gas properties.

The analysis area is approximately 685 square miles (438,284 acres); average well density if the entire area were developed would be 0.6 to 0.8 wells per square mile. Because the wells tend to occur in groups or pods depending on the structure of the coal seam, and are usually drilled on a 40-acre spacing, large portions of the project area would never see any activity. Developed areas may see up to 16 wells per square mile because of the 40-acre spacing. Drilling would be by small truck-mounted water well rigs. The drilling and completion of a well would require no more than seven people at a time. Eight to ten of these rigs may be running at any one time including logging and cementing rigs. Drilling operations disturb approximately a 100- by 100-foot area for a drill pad. A temporary mud pit of no more than 8 feet deep, 10 feet wide, and 20 feet long is normally required for each drilling and completion operation. If wells are air drilled, no mud pit would be constructed. Each producing well would be drilled to between a 350- and 1,200-foot depth and would have casing cemented to the top of the coal seam. Access to the wells would normally be by two-track road. Some roads could be upgraded at a later date if erosional problems occur.

The BLM has a general policy that requires access roads to oil and gas wells on federal lands to be crowned, ditched, and in most cases graveled or otherwise surfaced. For methane development, an exception may be made to this policy in consideration of the following factors: (1) The wells would be drilled using a water well rig. (2) After wells are completed and equipment is installed, travel to the wells would be generally limited to one visit per day in a light truck or utility vehicle to check on operations, read meters, and provide light service. (3) Such trips would be rescheduled or postponed during infrequent periods of wet weather when vehicular traffic could cause rutting. For some projects, wells would be tied into a central processing location adjacent to an all-weather road, thus eliminating daily trips to individual wells. (4) Troublesome areas, such as drainage crossings, would be upgraded as the need arises. Because the terrain in this area is flat, very little earthwork would be required in access road construction. Most of the access roads are on privately owned lands, and the owners have expressed a desire to have surface disturbance, including road construction, minimized. Based on the foregoing, the Proposed Action does not include crowned, ditched, and surfaced roads such as BLM requires in conventional oil and gas operations unless required to prevent erosional problems when identified. The conditions of approval developed during the APD approval process will guide what types of mitigation measures are required for access road development.

The project would occur through time as companies develop their various proposals. The drilling activity would correspond to an estimated three- to five-year timeframe. A certain number of wells would be drilled and hooked up to pipelines each year within limited portions of the project area. Company projections indicate that between 50 and 100 wells could be drilled in any given year, of which about one-half are likely to be federal wells. We estimate that no more than 190 wells would drilled be on federal minerals with a similar number being drilled on private and state minerals. Lower numbers of wells being drilled could result from various economic factors that would cause companies to limit activity resulting in as few as 200 total wells or 100 federal wells. The estimated productive life of the project is 10 to 20 years. A study conducted by the BLM indicates an estimated average well life of 12 years (USDI, BLM 1996).

The Proposed Action would consist of four basic components: a) the CBM wells, b) the gas gathering and delivery system, c) the water disposal system, and, d) the hydrologic monitoring system. These components are described below.

CBM Wells

CBM would be produced by drilling wells at selected locations in the Wyodak coal seam. This is the same seam that is being mined by 11 active surface coal mines in or adjacent to the assessment area (map 4). These coal mines are located along the outcrop of the coal seam where the relatively thin overburden is conducive to surface mining.

It would be necessary to pump water until the associated pressure decline in the coal bed is sufficient for methane to begin to flow into the well bore. In some wells, free methane would occur and water would not need to be pumped initially. Methane would be produced until reserves decline to subeconomic levels of methane production. Production from each CBM well is estimated to range from 50 to 500 thousand cubic feet (mcf) per day when the wells achieve optimal production.

The CBM wells would be located on anticlinal (dome-shaped) structures of the coal where free methane may exist in traps or where minimal pressure reductions are required to begin methane production. These structures in the coal are target CBM production sites because their shape provides natural traps for gas in the coal seam, and the structures are often associated with enhanced fracture permeability in the coal seam. This allows economic recovery of methane with fewer wells and reduced water production.

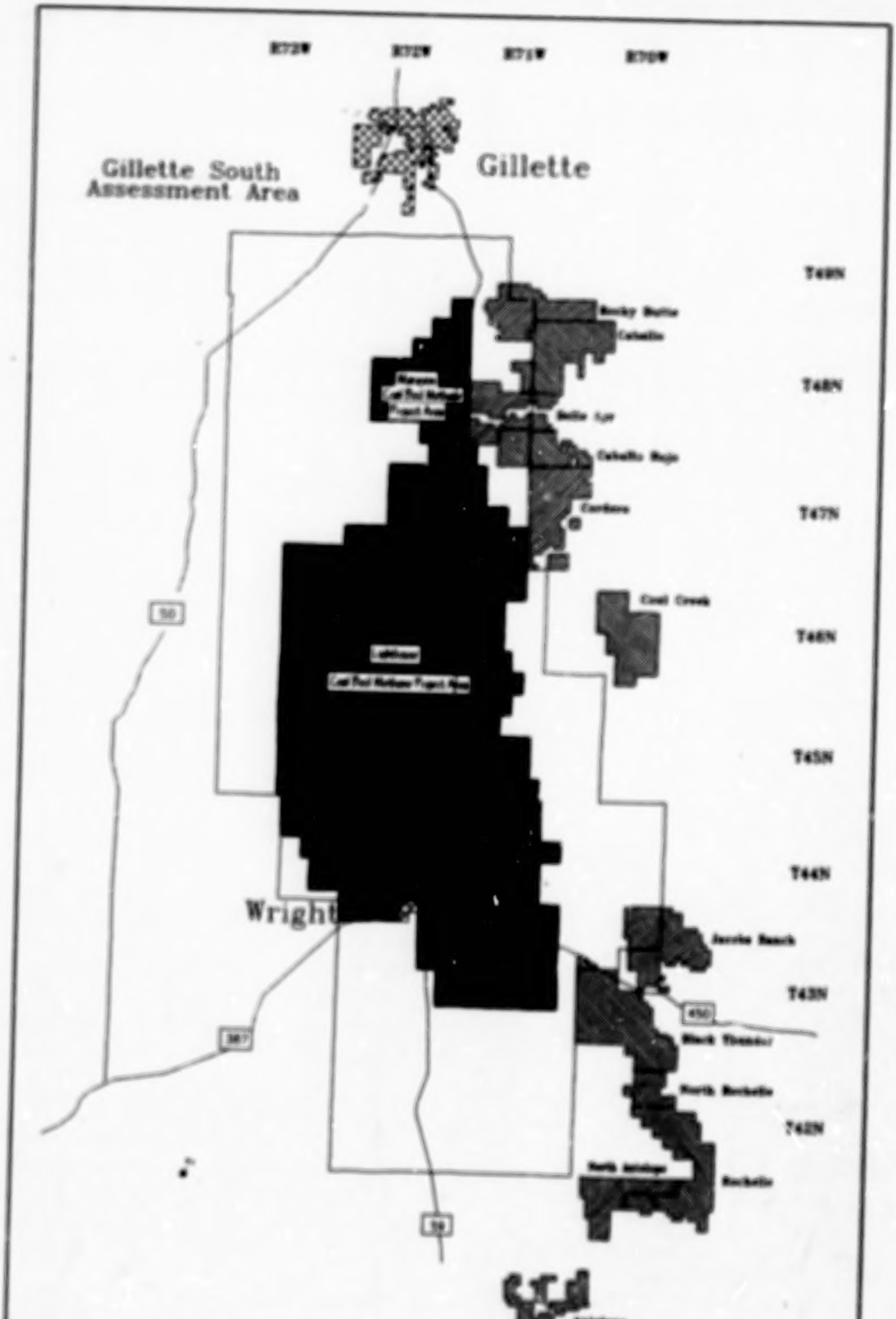
The CBM well bores would be uncased in the coal. The wells would be cased and cemented from the land surface to the top of the coal seam to prevent hydraulic communication (connection) through the well bore between the coal seam and the overlying Wasatch Formation. An unknown percentage of the proposed wells would require the installation of submersible pumps which would be used to produce water as necessary to lower the pressure in the coal seam, thus permitting methane to displace the water in the fractures (or cleats) in the coal seam and become available for recovery in the well. Other CBM wells would encounter free gas under pressure allowing the gas to be produced by flowing to the surface in tubing installed in the well bore. Wells encountering free gas would not require pump installation. Production of water is variable with initial production averaging 15 to 25 gallons per minute (gpm) and declining to 5 to 20 gpm depending on the well location within the coal seam. Production is expected to average no more than 20 gpm per well.

Development progression would depend on where company interest lies and the possibility of lease expirations. Typical well distribution would be a grouping or "pod" of approximately 25 to 50 wells. Within each "pod" two basic development scenarios have evolved. One scenario ties two to ten or more wells to a central gathering facility where the produced gas and water are separated. From this facility the gas would be transferred by buried pipeline to a central processing plant and thence to the pipeline. The second scenario has a water/gas separator at each well location. The gas is transferred by buried pipeline to a central processing plant. The first scenario would minimize the size of surface facilities used at the wellhead and lessen the visual intrusion on the landscape.

It is estimated that seven processing facilities would need to be constructed to handle the estimated production and sales. Incoming gas would be metered and then would flow into the gas line toward the compressor. Incoming water not removed at the production point would be separated from the gas and would be directed toward a permitted discharge point.

Each CBM well, upon completion and evaluation, would be tested for use as a methane production well. If found suitable, each well may be equipped with the following:

- a submersible pump (about one to five horsepower) to depressure the coal seam by evacuating sufficient water to initiate gas flow;
- a water-gas separator; and,



MAP 4
ADJACENT COAL MINES

- piping and fittings necessary to connect the wellhead with discharge lines to convey water to discharge facilities and gas to a compressor station.

If a well is not found suitable for production, it would be plugged and abandoned according to BLM and Wyoming Oil and Gas Conservation Commission (WOGCC) standards.

Power lines and water and gas lines used to connect production wells with facilities would be buried in trenches wherever possible. The gas and water lines would be laid in a trench approximately six feet deep. Electric lines may be laid in the same trench at a two-foot depth. Power to each well would be provided by Powder River Energy Corporation.

Gas Gathering and Delivery System

The gas gathering and delivery system would consist of black polyethylene pipe one and one-half to eight inches in diameter extending from each well to a compressor station which would compress the gas for delivery to a high-pressure gas transmission line. The gas line from the CBM wells to the compressor station would be installed using a ditch-witch or similar vehicle.

The pipeline would be assembled outside of the trench. After the pipeline is assembled and laid in the trench, the dirt would be bladed back into the trench and mounded to allow for settlement. The total width of disturbance along the trench would be less than 10 feet.

The proposed project would require construction of gas compressor facilities if sufficient compression capability is not available. These facilities would be constructed and operated by Western Gas Resources, Incorporated or KN Energy, Incorporated. Assuming that one compressor plant would be required for each pod of 50 to 60 wells, up to seven compressor facilities would be required for the projected 400 wells. Each of the compressor plants would be rated at between 800 and 1,400 horsepower and would be tied into large-diameter pipelines that already exist in the project area. These compressor stations would each occupy approximately one and one-half acres.

Water Disposal System

The water which must be pumped from the CBM wells to initiate gas flow would be disposed of by discharging it to area drainages after it passes through the water/gas separators (map 6). This disposal method has been used at the Rawhide Butte CBM project northwest of Gillette, the Marquiss project, and in the developed portions of the Lighthouse project.

To the extent possible, the water discharge lines from each well would be placed into the same trench as the gas gathering lines to minimize construction costs and surface disturbance. The water discharge lines, like the low-pressure gas lines, would be two- to four-inch diameter poly pipe depending on how many wells can be networked into the same line. The discharge lines would be networked such that several wells are linked together to one common discharge point. As has been done at the Marquiss, Lighthouse, and Rawhide Butte projects, discharge points would be selected after consultation with the landowners to find locations which would provide maximum benefits and with the BLM and Wyoming Department of Environmental Quality (WDEQ) to avoid sites which would result in adverse impacts.

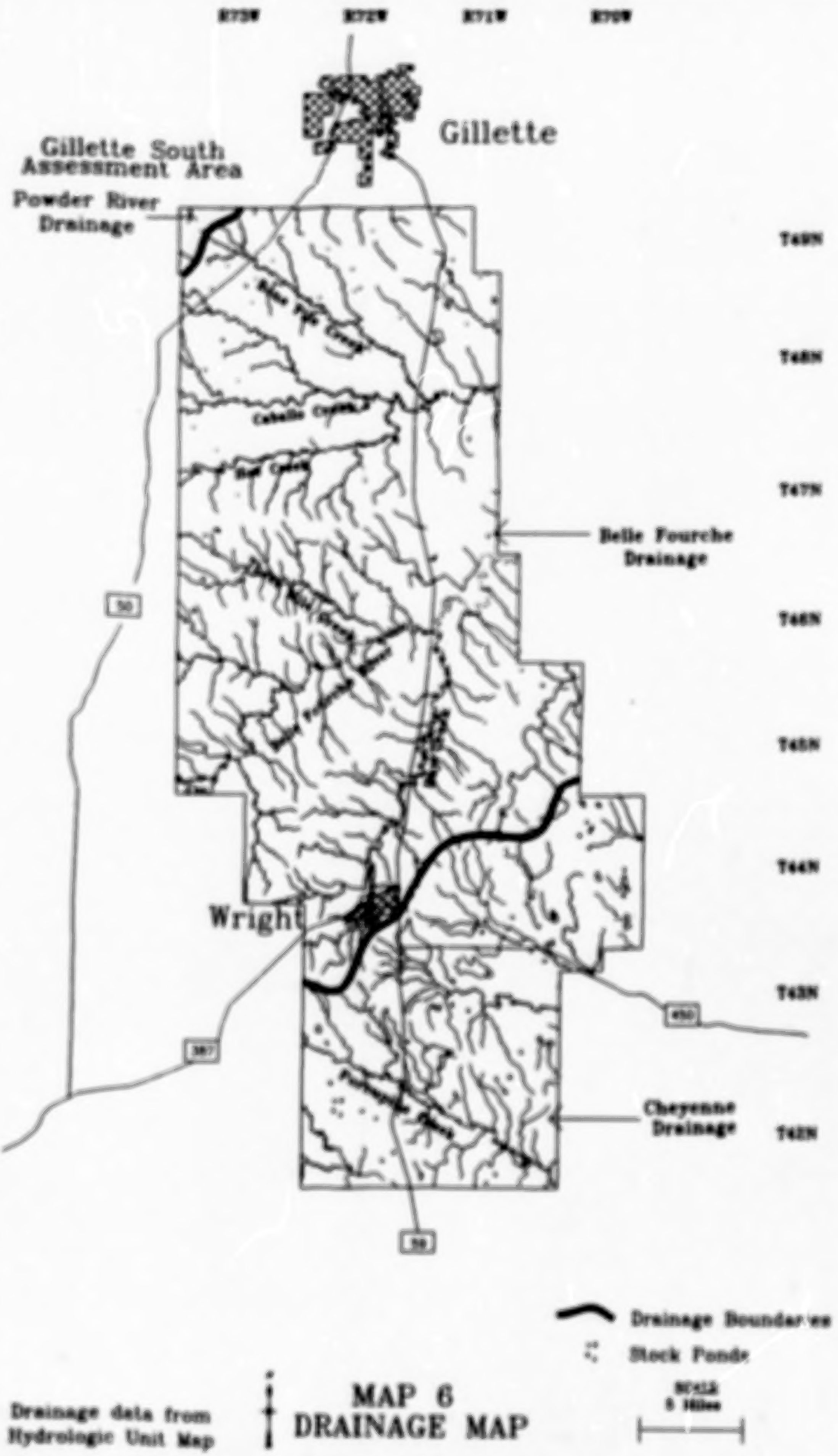
The receiving drainages would be tributaries to the Belle Fourche and Cheyenne rivers. The discharged water would most likely be distributed to approximately 80 points (or five wells per discharge point). Assuming an average maximum of 20 gpm per well, the discharge at any point should not exceed 100 gpm.

Hydrologic Monitoring System

An integral part of the Proposed Action is a hydrologic monitoring system required to detect impacts to other water users and to provide data for control and operation of the methane production project. The monitoring program would include groundwater and surface water monitoring, and the monitoring required under the terms of the National Pollution Discharge Elimination System (NPDES) discharge permit issued by the state of Wyoming. The monitoring program was designed to provide early warning if nearby water wells are susceptible to unacceptable loss in hydraulic head as a result of CBM development activities.

Whether production of methane occurs by encountering free gas trapped in the coal seam or by pumping water to reduce pressure and induce gas flow, it is possible that nearby water wells completed in the coal could experience a decline in head (for example, an increase in the depth to water in the well bore). If the decline in head is a significant part of the total available head at a particular water well, then that water well could experience a reduction in yield.

Monitoring has been occurring on the Lighthouse and Marquiss projects to validate predicted impacts and to identify the need to mitigate impacts. This monitoring would be continued and expanded to cover the Gillette South assessment area and would be in line with the Water Well Agreement worked out by the landowners and the operators (see the appendix in the draft EIS).



MAP 6
DRAINAGE MAP

Drainage data from
Hydrologic Unit Map

Specific Monitoring Activities

Groundwater. The following monitoring would be required of the various operators. The data would be submitted to the BLM as well as the appropriate state agency (Wyoming State Engineer's Office—WSEO, WDEQ, etc.).

- Baseline static water levels, productive capacity, and methane gas concentration: all properly permitted water wells within the circle of influence (COI) as defined by the Water Well Agreement located in the appendix of the draft EIS.
- Quarterly monitoring of selected wells within and around the project area. The CBM operator would be required to submit a monitoring plan to the BLM.
- Periodic monitoring of static water levels in CBM production wells as required by the WSEO. It is expected that the WSEO would require the operator to submit monthly reports containing the following information in addition to static water level measurements for each CBM well: (a) well name, permit number, and location; (b) reporting dates, name of individual responsible for report, and method of measurement; (c) total volumes of water and gas produced during the reporting period and cumulatively since reporting began; (d) bottom of hole pressure build-up during a minimum 8-hour shut-in period once every 45 days; and, (e) remarks or comments regarding data acquisition. These reporting requirements were established by the WSEO for coal bed methane projects.
- Cumulative monitoring of water production at each CBM production well.

The following is the monitoring to be done as a result of the Marquiss, Lighthouse, and Gillette South CBM projects by the BLM to provide independent verification of hydrologic activities. Depending on federal budget availability, it may become necessary for the CBM operators to pay for some or all of this monitoring through cost reimbursement. This has not been necessary throughout the initial Marquiss and Lighthouse projects.

- Continuous monitoring of groundwater levels and gas pressure of selected wells completed in the coal and periodic (one to two months) measurement of methane concentration at these wells. In addition, several of these monitoring sites would include additional well(s) completed in the next shallower sand(s) above the coal near the coal well (less than 300 feet). Some of the well sets include a coal completion well and a well completed in the next sand below the coal. Existing monitor wells are shown in table 1; wells proposed for installation in 1997 and beyond as part of the Lighthouse project are shown in table 2. The additional wells planned as part of the Gillette South project are shown in table 3. The proposed locations are approximate, and siting would depend on field conditions and development.

If adequate existing wells are available they may be substituted for some of the wells above (or possibly added to the network). Additional wells would be required with the additional development proposed in this EIS. It is anticipated that the ratio of monitoring wells required to the number of wells drilled would remain the same as for the currently permitted activity (one monitor well per 10 to 15 CBM wells or approximately one well set per township). Monitoring well schedule and final location would ultimately be a function of the final development scenario and development schedule.

TABLE 1

EXISTING MONITORING WELLS

WELL LOCATION	DEPTH (feet below land surface)	ZONE OF COMPLETION (feet)	STATE OF WYOMING PERMIT NUMBER	COMMENTS
T. 48 N., R. 72 W. SWSE, section 22	510	coal 430 - 510	completed 2-6-93 (U.W. 90658)	Coal well of a pair of wells completed for the Marquiss project.
T. 48 N., R. 72 W. SWSW, section 22	410	sand 340 - 410	completed 2-6-93 (U.W. 90659)	Sand well of well pair.
T. 47 N., R. 72 W. SWNW, section 2	407	coal 327 - 407	completed 4-1-93 (U.W. 90656)	Coal well of a pair of wells completed for the Marquiss project.
T. 47 N., R. 72 W. SWNW, section 2	310	sand 260 - 310	completed 4-1-93 (U.W. 90657)	Sand well of well pair.
T. 47 N., R. 72 W. SWNW, section 36	500	coal	NONE	Existing (Amoco well).
T. 47 N., R. 71 W. SWSW, section 19	392	coal 337-387	existing (P82851W)	Existing (Cordero well).
T. 46 N., R. 72 W. section 16	800 (approx.)	coal	existing	Use this existing American well for monitoring or until needed for production.
T. 46 N., R. 72 W. NESW, section 6	359	coal 313-353	existing (P82852W)	Existing (Cordero well).
T. 46 N., R. 72 W. SWSW, section 25	525	coal 420-525	completed 11-96	Coal well of pair.
T. 46 N., R. 72 W. SWSW, section 25	175	sand 140-170	completed 11-96	Sand well of pair.
T. 45 N., R. 75 W. NESW, section 31	1648	coal 1459-1559	existing (P88746W)	Shogrin Federal #2 acquired from Exxon 11-96.

TABLE 2

PLANNED LIGHTHOUSE DEDICATED MONITORING WELLS

WELL LOCATION	TARGET ZONE OF COMPLETION	COMMENTS
SW¼NW¼, Sec. 36 T. 46 N., R. 72 W.	Wyodak/Anderson Coal	Coal well of pair. This well will be drilled to replace the production well currently used for monitoring.
SW¼NW¼, Sec. 36 T. 46 N., R. 72 W.	Sand zone above coal	Sand well of pair. Well would be completed in the sand zone closest to the top of the coal.
SE¼SE¼, Sec. 31 T. 46 N., R. 72 W.	Wyodak/Anderson Coal	Coal well of pair.
SE¼SE¼, Sec. 31 T. 45 N., R. 72 W.	Sand zone above coal	Sand well of pair. Well would be completed in the sand zone closest to the top of the coal.
NW¼SW¼, Sec. 23 T. 45 N., R. 72 W.	Wyodak/Anderson Coal	Coal well of pair.
NW¼SE¼, Sec. 23 T. 45 N., R. 72 W.	Sand zone above coal	Sand well of pair. Well would be completed in the sand zone closest to the top of the coal.
SW¼SW¼, Sec. 30 T. 44 N., R. 71 W.	Wyodak/Anderson Coal	Coal well of triple.
SW¼SW¼, Sec. 30 T. 44 N., R. 71 W.	Sand zone above coal	Sand well of triple. Well would be completed in the sand zone closest to the top of the coal.
SW¼SW¼, Sec. 30 ¼ T. 44 N., R. 71 W.	Sand zone below coal	Sand well of triple. Well would be completed in the sand zone closest to the bottom of the coal.
Sec. 7, T. 44 N., R. 72 W. OR: Sec. 14, T. 44 N., R. 73 W.	Wyodak/Anderson Coal	Coal well of pair. This well pair would be developed at a later date as development moves in a westward direction.
Sec. 7, T. 44 N., R. 72 W. OR: Sec. 14, T. 44 N., R. 73 W.	Sand zone above coal	Sand well of pair. This well pair would be developed at a later date as development moves in a westward direction.

TABLE 3

PLANNED GILLETTE SOUTH DEDICATED MONITORING WELLS

WELL LOCATION	TARGET ZONE OF COMPLETION	COMMENTS
Sec. 36, T. 49 N., R. 73 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 2, T. 47 N., R. 72 W.	Wasatch Sand	Complete at existing well pair site.
Sec. 7, T. 47 N., R. 73 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 16, T. 47 N., R.73 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 11, T. 46 N., R. 74 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 16, T. 45 N., R. 74 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 21, T. 45 N., R.73 W. or Sec. 6, T. 44 N., R. 73 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 36, T. 45 N., R. 72 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 36, T. 45 N., R. 71 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 36, T. 43 N., R. 74 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 16, T. 43 N., R. 72 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 21, T. 43 N., R. 71 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 36, T. 42 N., R. 74 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 32, T. 42 N., R. 73 W.	Wyodak / Anderson Coal	Coal/sand well set*.
Sec. 29, T. 41 N., R.72 W.	Wyodak / Anderson Coal	Coal/sand well set*.

*"Well set" includes one coal completion plus one or more sand wells.

- Periodic spot checking of measurements made by operators on their monitoring wells.
- Periodic (one to two times per year) monitoring of additional water wells that operators are not monitoring further from the project area.
- Water quality samples would be taken from the monitoring wells on a semi-annual basis and analyzed for the following constituents.

Parameter	Unit
pH	Std Units
Electrical conductivity	umhos/cm
Bicarbonate	mg/l
Chloride	mg/l
Sulfate	mg/l
Carbonate	mg/l
Fluoride	mg/l
Calcium	mg/l
Potassium	mg/l
Magnesium	mg/l
Sodium	mg/l
Aluminum	µg/l
Arsenic	µg/l
Barium	µg/l
Boron	µg/l
Cadmium	µg/l
Chromium	µg/l
Copper	µg/l
Iron	µg/l
Lead	µg/l
Mercury	µg/l
Selenium	µg/l
Silica	µg/l
Silver	µg/l
Zinc	µg/l

- At least one multi-well aquifer test would be run to validate the assumptions of aquifer anisotropy and aquifer characteristics presented in this EIS. This test, or aquifer characterization study, would be completed in 1997.
- Additional Monitoring Wells

  BLM would convert additional stratigraphic test holes to monitoring wells as stratigraphic testing moves into areas which currently lack monitoring wells. Costs and scheduling would be negotiated on a well-by-well basis.

Surface Water. The following is the monitoring that would be required of the operators:

- Monitoring of volume and quality of produced water being discharged to the surface as required by the WDEQ under the NPDES.
- Additional surface water stations may be required on Black Thunder Creek, Coal Creek, Little Thunder Creek, and/or Porcupine Creek and/or their tributaries. This would depend on the location of discharge points, availability of existing data, and magnitude of projected impact. The cost of this monitoring would have to be shared by the BLM and the CBM operators. With the projected BLM budgets, it is anticipated that the operators would have to shoulder the bulk of this cost.

The following is the monitoring that would be done by the BLM:

- Operation of a surface water gauging station on the Belle Fourche River below the area to be affected by surface discharge of produced water from the assessment area and above the areas influenced by the coal mines. In addition, a station is currently being operated on Caballo Creek by the Cordero Mine.

  At the Belle Fourche station, stream flow, water temperature, and electrical conductivity of the water would be continuously recorded. In addition, periodic manually collected samples would be analyzed for the constituents listed previously with the addition of total suspended sediments (TSS).
- Periodic check sampling of water quality would be done at the assessment area discharge points and analyzed as above.
- Channels receiving the produced water would be monitored for signs of accelerated erosion and degradation.

Cost Share on Wells to be Monitored by BLM. Where suitable wells do not exist for monitoring, operators would be required to obtain access, permit, drill, and properly complete wells (including casing, screen where appropriate, sand pack where appropriate, logging, and cementing) where necessary, in relation to their projects. The BLM would provide and install all instrumentation and necessary support facilities (shelter and fence).

Implementation of Monitoring. As individual operators propose projects, monitoring needs would be assessed to ensure sufficient data is gathered through monitoring so drawdown impacts can be tracked. Table 3 identifies currently planned monitoring wells for the Gillette South project. As drilling proceeds additional monitoring wells would be identified and added to the monitoring network.

The well locations and scheduling in tables 2 and 3 are approximate. If adequate existing wells are available they may be substituted for some of the wells above (or possibly added to the network). The monitoring well schedule and final location would ultimately be a function of the final development scenario and development schedule.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

Restrict Timing on Approval of Federal Wells

This alternative considered slowing the rate of approval for 190 federal wells. It was not analyzed in detail because there is enough flexibility in implementing the Proposed Action to regulate the timing of approval for the 190 federal wells. The decision to approve each well is based on the site-specific analysis completed for each APD. The rate at which federal wells are approved could be slowed down, but the mix of mineral ownership in the assessment area would lead to proportionally more wells being drilled on private and state leases to make up for the reduced number of federal wells approved. This could lead to drainage of federal gas. Impacts of this alternative would be less than the Proposed Action if total fewer wells are actually drilled over time. If more private and state wells are drilled to compensate for the slower rate at which federal wells are approved, impacts would be the same as the Proposed Action. For this reason, this alternative has not been analyzed in detail.

Reduce the Number of Federal Wells Approved

This alternative considered the drilling of fewer than 190 federal wells in a sequential manner. It was not analyzed in detail because there is enough flexibility in the implementation of the Proposed Action to approve fewer than 190 federal wells. Additionally, the mix of mineral ownership in the assessment area (41% federal minerals) would lead to proportionally more wells being drilled on private and state leases to make up for the reduced number of federal wells approved. To approve fewer than 190 federal wells could lead to a drainage of federal gas. Impacts of this alternative would be less than the Proposed Action if the total number of wells drilled was less than 400. If private and state leases are developed at an increased rate to compensate for fewer federal wells being approved, the impacts would be the same as the Proposed Action. For this reason, this alternative was not analyzed in detail.

The following two alternatives are not true alternatives to the Proposed Action; rather, they are variations to how water disposal is handled. They are included in response to scoping comments and comments made on the draft EIS.

Change the Method of Surface Water Disposal

Drilling and production would be the same as that described under the Proposed Action, but surface water disposal methods would be modified. This alternative was not analyzed in detail because current water discharges in three existing projects (which have been producing coal bed methane for up to seven years) have not caused any major problems. Also, discharges are regulated by the state of Wyoming under NPDES, and the produced water from this project would meet those standards.

Inject Produced Water Underground

Drilling and production would be the same as that described under the Proposed Action, but produced water would be injected underground. Produced water from existing projects has been of relatively good quality. Total dissolved solid (TDS) levels have been from 500 to 1,000 milligrams per liter (mg/l), well within Wyoming standards for livestock water. The produced water can only be disposed of in aquifers exempt from the definition of fresh and potable water (WOGCC 1989). Injection of this water into an exempt formation would make water now suitable for irrigation and livestock unusable for any future use and would only mitigate potential surface water impacts and none of the potential groundwater impacts. Reinjection into the coal seam might be feasible but would also defeat the purpose of removing water from the coal seam to produce methane. Also, reinjection would require a system of wells and pipelines that would increase the total surface disturbance. Finally, because the produced water is suitable for livestock and wildlife and possibly irrigation, it should be put to beneficial uses rather than injected into an aquifer of lesser quality.

THE NO ACTION ALTERNATIVE

The No Action Alternative would be to reject all applications for federal wells. 40CFR 1502.14(d) of the Council on Environmental Quality (CEQ) regulations requires that alternatives analysis in the EIS "include the alternative of no action." The Department of the Interior's authority to implement a No Action alternative is limited. An explanation of this limitation and the discretion the Department has in this regard is as follows.

> An oil and gas lease grants the lessee the "right and privilege to drill for, mine, extract, remove and dispose of all oil and gas deposits" in the leased lands, subject to the terms and conditions incorporated in the lease (Form 3110-2). Because the

Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases, restrictions are imposed on the lease terms.

Leases within the assessment area contain various stipulations concerning surface disturbance, surface occupancy, and limited surface use. In addition, the lease stipulations provide that the Department of the Interior may impose "such reasonable conditions, not inconsistent with the purposes for which the lease is issued, as the BLM may require to protect the surface of these leased lands and environment." None of the stipulations would empower the Secretary of the Interior to deny all drilling activity because of environmental concerns.

Provisions in leases that expressly provide Secretarial authority to deny or restrict APD development in whole or in part would depend on an opinion provided by the U.S. Fish and Wildlife Service (FWS) regarding impacts to endangered or threatened species or habitats of plants or animals that are listed or proposed for listing (for example, bald eagle). If the FWS concludes that the Proposed Action and alternatives would likely jeopardize the continued existence of any endangered or threatened plant or animal species, then the APD(s) and related development may be denied in whole or in part on the federal leases. Development could still proceed on the private and state leases.

CHAPTER 3

THE AFFECTED ENVIRONMENT

ERRATA

Table 8, from page 41 of the draft EIS, has been reprinted because a new column, "Drinking Water Standard," has been added.

TABLE 8

CHEMICAL ANALYSES OF WATERS FROM THE BELLE FOURCHE RIVER BELOW RATTLESNAKE CREEK NEAR PINEY, WYOMING

SITE DESCRIPTION: Belle Fourche River below Rattlesnake Creek. Site located just below the Hilight Road. USGS Site ID 06425720.

LOCATION: North latitude 43-59-04, west longitude 105-23-16.

DRAINAGE AREA: 495 square miles.

PERIOD OF OPERATION: November 6, 1975 through April 13, 1983, and 1994 to the present.

PARAMETER	UNIT	NUMBER OF SAMPLES	MEAN	DRINKING WATER STANDARD	MAXIMUM	MINIMUM
Water temperature	°C	59	12.31		23.5	0.0
Discharge	cfs	102	13.14		1,060.0	0.0
Specific conductivity	umhos/cm	43	3,962.00		8,000.0	1,100.0
pH	standard units	38	7.91	none	8.1	7.6
Total organic carbon	mg/l	5	9.64		16.0	6.4
Calcium *	mg/l	36	270.00		530.0	95.0
Magnesium *	mg/l	36	171.00		530.0	35.0
Sodium *	mg/l	36	400.00	none	1,200.0	100.0
Potassium *	mg/l	36	16.00		45.0	6.4
Chloride *	mg/l	36	20.00	250 (recommended)	55.0	4.1
Sulfate *	mg/l	36	1,957.00	250 (recommended)	5,400.0	510.0
Fluoride *	mg/l	36	0.45	1.4 to 2.4	0.9	0.2
Silica *	mg/l	36	3.80		9.4	0.2
Silver *	µg/l	10	1.10	5	1.0	2.0
Barium *	µg/l	4	87.50	1,000	100.0	50.0
Beryllium *	µg/l	9	7.90	none	10.0	0.0
Boron *	µg/l	36	151.00	none	810.0	50.0
Cadmium *	µg/l	10	2.40	10	10.0	0.0
Chromium *	µg/l	10	5.00	50	20.0	0.0
Copper *	µg/l	10	3.10	none	7.0	1.0
Iron *	µg/l	36	77.60	none	410.0	10.0
Lead *	µg/l	10	3.90	50	21.0	0.0
Manganese *	µg/l	14	234.00	none	800.0	59.0
Molybdenum *	µg/l	5	2.20		4.0	0.0

TABLE 8 (Continued)

CHEMICAL ANALYSES OF WATERS FROM THE BELLE FOURCHE RIVER BELOW RATTLESNAKE CREEK NEAR PINEY, WYOMING

SITE DESCRIPTION: Belle Fourche River below Rattlesnake Creek. Site located just below the Hilight Road. USGS Site ID 06425720.

LOCATION: North latitude 43-59-04, west longitude 105-23-16.

DRAINAGE AREA: 495 square miles.

PERIOD OF OPERATION: November 6, 1975 through April 13, 1983, and 1994 to the present.

PARAMETER	UNIT	NUMBER OF SAMPLES	MEAN	DRINKING WATER STANDARD	MAXIMUM	MINIMUM
Nickel *	uµ/l	10	3.40	none	6.0	1.0
Arsenic *	µg/l	1	0.00	50	0.0	0.0
Strontium *	µg/l	3	2,367.00		3,400.0	1,800.0
Vanadium *	µg/l	4	.325		1.0	0.0
Zinc *	µg/l	10	20.40	50	40.0	4.0
Aluminum *	µg/l	6	36.70		100.0	10.0
Lithium *	uµ/l	8	114.00		300.0	34.0
Selenium *	µg/l	10	1.00	10	2.0	0.0
Uranium *	µg/l	3	9.23		17.0	1.7
Total dissolved solids	mg/l	33	3,046.00	500 (recommended)	7,870.0	809.0
Mercury *	µg/l	10	0.15	2	0.5	0.0

* Total dissolved.

On page 46, first paragraph, last line, the sentence should read, "An inventory done **in 1994 and 1995** by The Nature Conservancy . . . ."

On page 47, under "Land Use and Transportation," the sentence should read, "In the assessment....administered by the BLM or **Forest Service**, about....and the remaining **89%** is private surface (map 2)." On page 51, under Air Quality, the units of $\mu g/l^3$ should be **$\mu g/m^3$** in both the first and second paragraphs.

Because it is referred to frequently in this final EIS, table 12 from page 52 of the draft EIS has been reprinted below with a correction to footnote "**May not be exceeded more than one day per year."

TABLE 12

NATIONAL AND WYOMING AIR QUALITY STANDARDS

Air Pollutant	Averaging Period	Wyoming Standard ($\mu g/m^3$)[b]	NAAQS[a] ($\mu g/m^3$)[b]
Total suspended particulates (TSP)[c]	24-hour[d]	150	—
Respirable particulate matter (PM_{10})[c]	24-hour[d]	150	150
	annual[e]	50	50
Nitrogen oxide	annual[e]	100	100
Photochemical oxidant (ozone)	1-hour[d]	160	23
Sulfur dioxide	3-hour[d]	1,300	—
	24-hour[d]	260	365
	annual[e]	60	80
Carbon monoxide	1-hour[d]	40,000	40,000
	8-hour[d]	10,000	10,000

[a] National ambient air quality standard.

[b] ($\mu g/m^3$) = micrograms per cubic meter.

[c] Particulates are very small-diameter solids or liquids. Materials handling processes such as crushing or grinding rock or loading dry materials in bulk can result in the creation of fine dusts. Vehicle traffic on dirt and gravel roads also generates large quantities of dust. Combustion processes can also emit small particles of noncombustible ash or incompletely burned soot. TSP includes all particulates suspended in the atmosphere. Respirable particulate matter is the very fine fraction (less than 10 microns in diameter) which can penetrate deep into the lungs and cause health problems.

[d] May not be exceeded more than one day per year.

[e] Arithmetic mean may not be exceeded.

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CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

IMPACTS TO SOCIOECONOMICS

The following is an additional socioeconomic impact analysis to that presented in the draft EIS. It covers employment, personal income, royalties, and taxes.

The impacts of the development as outlined in this document are quantitatively defined. As many as 400 wells, 190 on federal lands, may be drilled under the Proposed Action over a three- to five-year period. Alternative proposals exist for a slower rate of development and for a fewer number of wells with a lower limit of 200 wells, 100 on federal lands.

Already 129 wells are producing on state and private mineral lands within the assessment area; 11 wells are producing on federal minerals. Existing two-track roads would be used wherever possible, thus limiting the need for construction of additional roads, and the workers that would be associated with that construction. The wells would be drilled using small truck-mounted water well drills. Drilling, completion, and pipeline construction for each well involves approximately seven people per well. Four full-time employees per company would be needed for each of the eight companies during the production phase of the project for well inspection, maintenance, and service. Finally, abandonment of the project would involve several people to dismantle and remove aboveground facilities and plug the wells.

Employment and Personal Income

Using an average of four years to drill these wells, this gives 100 wells per year. At an estimated 15 work days to drill, complete, and install production facilities for each well, this calculates six full-time equivalent (FTE) jobs per year for each year of the four years of development. The average annual income for each of these six full time equivalent workers associated with the proposed action is estimated to be $40,697, which calculates to an annual personal income or payroll of $245,802. Over four years this is estimated to be $983,208.

Using an employment multiplier of 2.4, according to the U. S. Bureau of Economic Analysis, 1.4 additional jobs would be generated for each full-time equivalent job in the gas industry. Therefore eight additional jobs would be generated in other sectors in the states's economy. Not all of these jobs would be in the local economy, but if half were, an additional 4 jobs would be generated in the local economy. Using an income multiplier of 1.778 this would generate an additional personal income of which one-half would be applicable to the local economy of $95,617, for a total payroll of $1,365,676 over four years.

Federal Royalty and Production Taxes

The market price for coal bed methane has been highly volatile; accordingly, a potential price of $1.00 per mcf over the life of the project is assumed.

Assuming a well produces 241 mmcf to 420 mmcf over the life of the well, 400 wells would yield 96.4 to 168 billion cubic feet of gas. This would generate a sales value of $96.4 to $168 million. Using the upper limit this would generate $9,975,000 of federal royalty; the states's share would be $4,987,500. Severance taxes would be $9,481,500; the share from federal resources would be $4,189,500. Ad valorem taxes would be $12,025,702, with the share from federal resources of $5,313,682. The total of royalty and production taxes from the federal lands would be $19,478,182, and the total funds received by the state and county would be $26,494,702.

Sales and Use Tax

The State of Wyoming collects a 4% sales and use tax on the purchase and use of tangible goods. In addition, Campbell County levies an additional 1%, making a total of 5%. Applying an estimated factor of 60% of well drilling, completion, and well facilities, a well cost of $50,000 per well gives a tangible taxable value of $30,000 per well. At the allowed sales and use tax rate of 5%, each well has a tax value of $1,500. For the total number of wells this gives a total tax $60,000 for the Proposed Action.

Workers employed by the Proposed Action would spend their income on sales and use taxable goods and services. With an estimated personal income or annual payroll of $245,802 of direct employment and one-half of the indirect employment, $95,617, gives a total annual personal income of $341,419. Assuming that 32.4% of this income would be spent on taxable items, more than $22,000 in sales and use taxes would be generated in four years.

During the production phase of the this gas project the annual projected employment would be 32 full-time equivalent jobs, and assuming one-half of the indirect jobs are in the area, 22 additional jobs would be generated. The total direct and indirect personal income is calculated to be $1,808,900 per year. Using an average of 11 years as productive life, the total personal income would be $19,897,900 during the life of the project. Using similar assumptions as above, the sales and use tax impact would be an additional $322,346.

IMPACTS TO AIR QUALITY

Air quality impacts were further examined to determine what effect CBM development would have in and adjacent to the assessment area. National and Wyoming air quality standards are shown in table 12 of the final EIS.

The produced gases from the project will be methane, nitrogen, and carbon dioxide as can be seen on figure 14. Benzene, toluene, ethyl-benzene (BTEX), or volatile organic compounds (VOCs) are not present in the gas stream. Since the methane will be used to fuel the gas compressor engines, air quality impacts for nitrogen oxides and carbon monoxide were examined.

The WDEQ/Air Quality Division (AQD) provided assistance in determining nitrogen oxides (NOx) and carbon monoxide (CO) impacts. The Division modeled two scenarios—a single Waukesha 7042 1,400-horsepower compressor engine and two Waukesha 7042 1,400-horsepower compressor engines located at the same place. EPA's Industrial Source Complex Long Term Model (ISCLT3) was used to determine the NOx impacts from these two scenarios.

The WDEQ/AQD's experience with these engines was used to provide some guidance to the BLM in determining appropriate inputs for the models. Emission rates used in both scenarios were based on a typical Waukesha 7042 compressor engine that has a NOx emission rate of 2.0 grams/hp-hr, and a CO emission rate of 3.0 grams/hp-hr. This is a worst case scenario for the modeling. Actual emissions for engines being installed in the EIS assessment area are shown in figure 15. The model was run using flat terrain and no building downwash. This is a simplified modeling analysis that can be used to illustrate the pollutant impacts from one or two of these 1,400-horsepower compressor engines. Cumulative impacts from additional sources were not treated in this analysis, and no attempt should be made to draw any conclusions relating to cumulative impacts from this analysis by itself.

The ISCLT3 model predicted that the maximum annual concentration of NOx would be 2.28 micrograms per cubic meter. An analysis of the isopleth plots derived from the model output data shows that the concentrations decrease with increasing distance from the source(s) modeled (figure 16). If a second 1,400-horsepower compressor were located immediately adjacent to the first compressor, the maximum modeled annual concentration would increase to 4.56 micrograms per cubic meter (figure 17).

Carbon monoxide impacts were analyzed using the SCREEN3 model; this model is limited to analyzing the impacts from a single source. As stated above, a 3.0 grams/hp-hr emission factor was used to represent typical CO emissions from a catalytically controlled or lean-burn controlled engine. The maximum modeled 1-hour CO concentration predicted by the model was 87.57 micrograms per cubic meter. Since the SCREEN3 model produces 1-hour concentrations, a worst-case correlation correction was applied to determine a representative 8-hour concentration from the predicted 1-hour concentration. Therefore, the 1-hour predicted concentration was multiplied by 0.9. The resulting 8-hour model predicted concentration is then 78.81 micrograms per cubic meter.

The modeling analyses for NOx and CO predict that the impacts due to emissions from one or two compressor engines at a given compressor site are well within the standards shown in table 12 reprinted in chapter 3 of this final EIS.

CUMULATIVE IMPACTS

Air Quality

The following is an additional cumulative impacts analysis to that presented in the draft EIS.

The Wyoming and National ambient air quality standards are shown in table 12 in chapter 3 of this final EIS. The two pollutants of concern from the proposed action are nitrogen oxides and carbon monoxide. The background concentration for NOx in and adjacent to the EIS assessment area is 20 micrograms per cubic meter.

The WDEQ/AQD has modeled emissions from a single controlled 1,400-horsepower compressor engine, and from two controlled 1,400-horsepower compressor engines (figures 16 and 17). The maximum modeled annual concentration of NOx was 2.28 micrograms per cubic meter for one compressor engine and 4.56 micrograms per cubic meter for two compressor engines assuming the compressors were located immediately adjacent to each other.

One could assume that seven compressor stations would be located within the area influenced by the proposed power plants and existing sources. However, this is not likely to be the case. In reality, the compressor stations will be distributed throughout the assessment area. To date, for the Marquiss and Lighthouse projects, we have seen approximately one compressor station

```
                    EG&G Chandler Engineering
                   Model 292 Gas Chromatograph

Test time: Mar.17 97 09:30                      Calibration #:    2
Test Sample #:3                                 Location No.91571000

                ___ Standard/Dry  Analysis ___        Saturated Analysis
                MoleX       BTU# R.Den.#   GPM**      MoleX      BTU# R.Den.#
Methane        91.995    931.33  0.5096      --      90.394    915.12  0.5007
Ethane          0.063      1.11  0.0006  0.0167       0.061      1.09  0.0006
( C6+ )         0.044      2.22  0.0014  0.0188       0.043      2.18  0.0014
Moisture        0.000      0.00  0.0000      --       1.740      0.88  0.0108
Nitrogen        6.549      0.00  0.0633      --       6.435      0.00  0.0622
( CO2 )         1.349      0.00  0.0205      --       1.326      0.00  0.0201

Total          100.00     934.7  0.5955  0.0356      100.00     919.3  0.5959
* : Uncorrected for compressibility at  60.0F & 14.73PSIA.
**: Liquid Volume reported at 60.0F.

                              Standard/Dry  Analysis    Saturated Analysis
Molar Mass                =      17.246                  17.260
Relative Density          =      0.5964                  0.5969
Compressibility Factor    =      0.9981                  0.9980
Heating Value             =      20518. Btu/lb           20165. Btu/lb
Heating Value             =       936.4 Btu/CF            921.1 Btu/CF
Absolute Gas Density      =       45.64 lbm/1000CF        45.68 lbm/1000CF
Unnormalized Total % :           96.426
Last Calibrated with Calgas of      1388.7 Btu/CF     Nov.25 96 15:34
C6+ Last Update:  GPA 2261-90.
     C6+ BTU/CF 5065.8, C6+ lbm/Gal  5.6425, and C6+ Mol.Wt.  92.00.
```

FIGURE 14
GAS ANALYSIS

SAMPLE
ATTACHMENT #1

Western Gas Resource, Inc

GENERAL EMISSIONS TEST FORM

Date of Test: 17-Jun-96 **Quarter:** 2nd

Area: Powder River **Facility:** Crossbow Booster

Air Permit #: CT-1178 **Unit #:** 2 **Service:** Compression

Engine: Waukesha **Model:** 7042GSI **RPM:** 1119

Rated Hp: 1400 **Horsepower at time of testing:** 738

Ignition Timing: 25 **Intake Manifold Pressure:** 1

Fuel Consumption: 105 mcfd **Specific Gravity** 0.593

Stack Height: 33 ft. **Stack Diameter:** 12 inches

Air/Fuel Controller - Make: Dynalco **Model:** Proto Type

Catalytic Converter Make: Miratec **Model:** Custom

PERMITTED LIMITS:

Carbon Monoxide: 3

NOx: 2

CALCULATED EMISSIONS FROM TEST:

CO	**0.60 lbs/hr**	**0.37 Grams/Hp-Hr**
NOx	**0.25 lbs/hr**	**0.15 Grams/Hp-Hr**

Jerry Jeffers

Jerry Jeffers
Environmental Compliance

John Lee

John Lee
Mechanic

BUREAU OF LAND MANAGEMENT
BUFFALO RESOURCE AREA
97 JUN -5 PM 12:57

FIGURE 15

COMPRESSOR EMISSIONS TEST SHEET

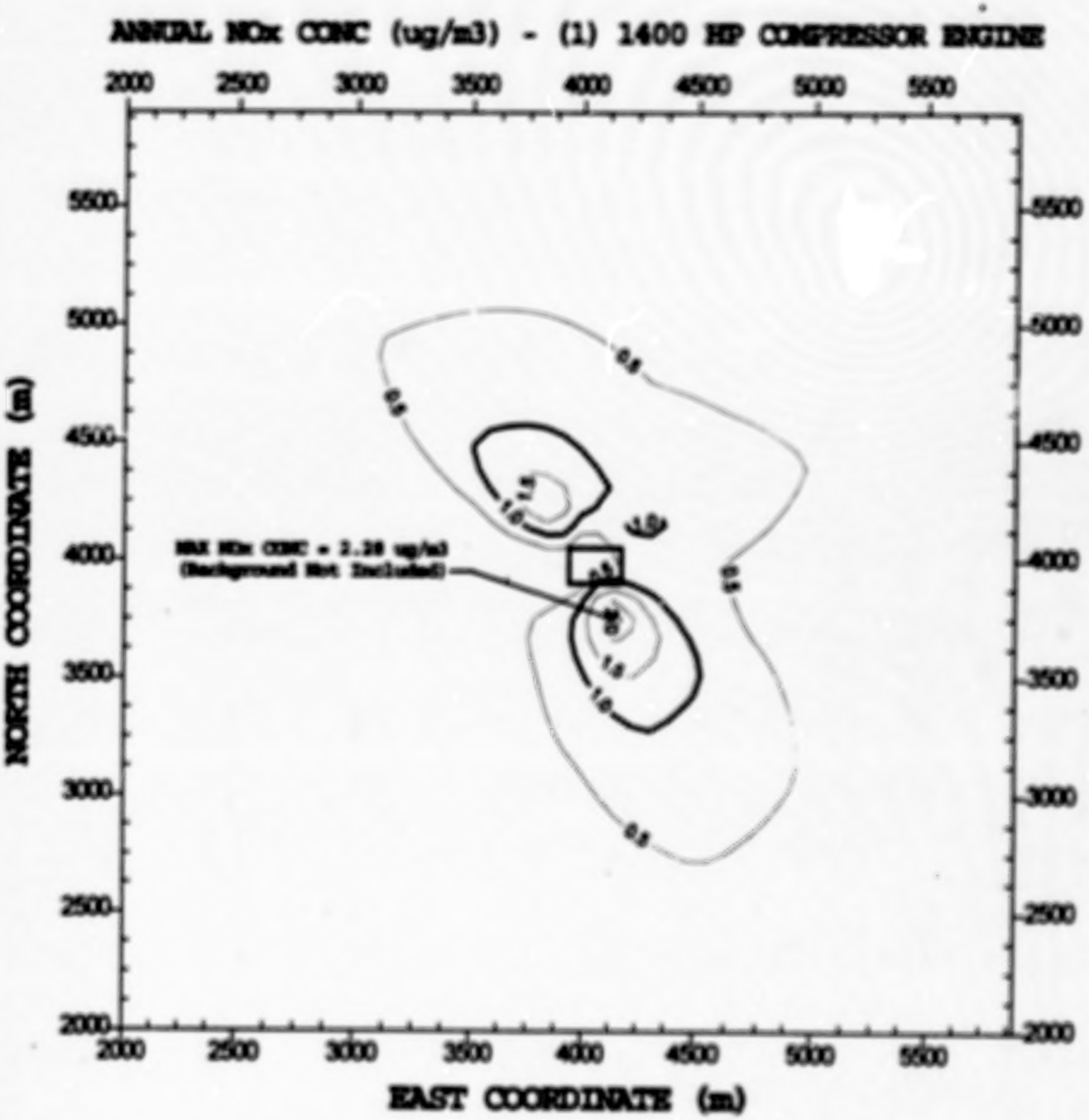
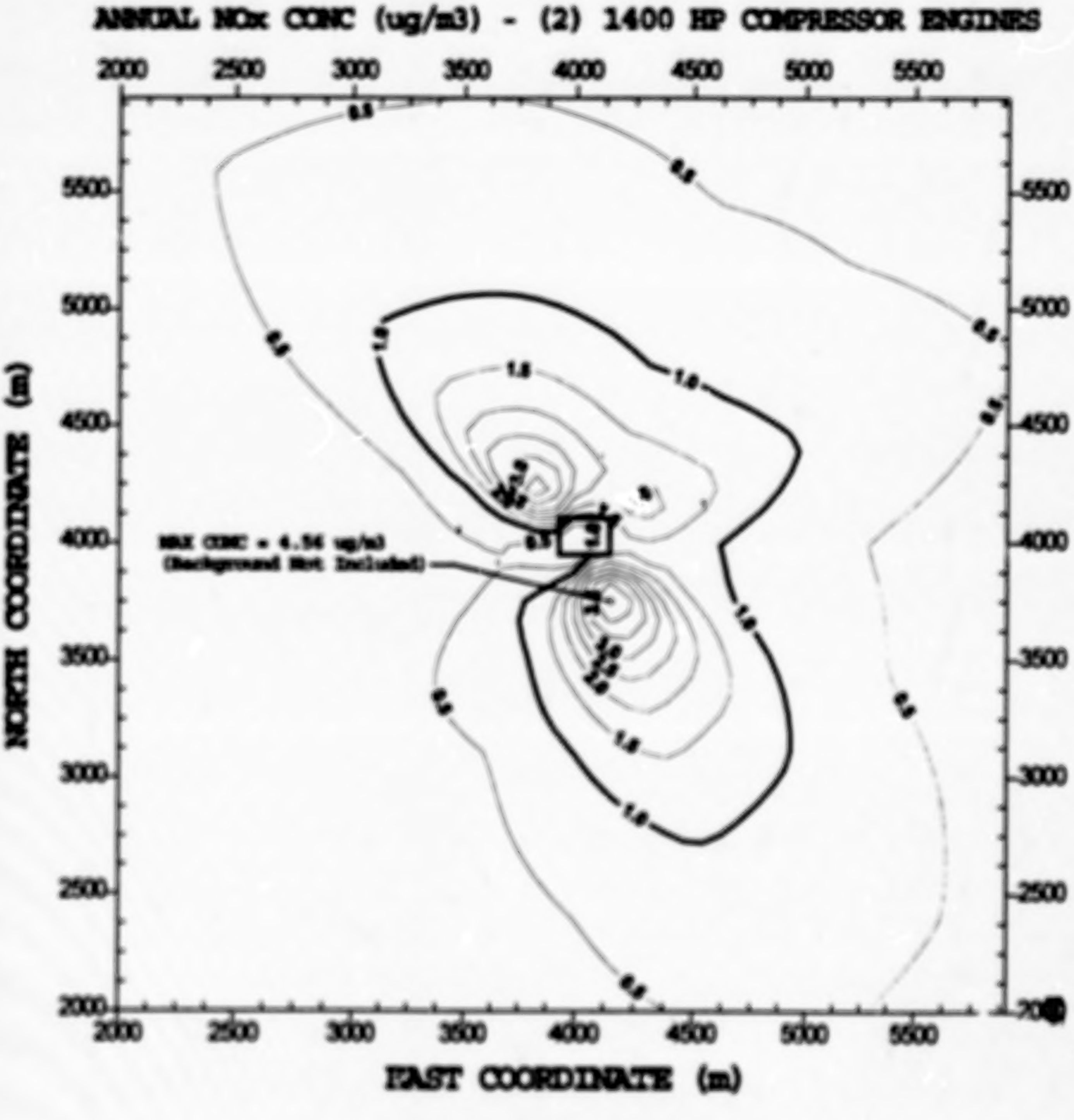


FIGURE 16

COMPRESSOR ENGINE MODEL FOR NOX (ONE ENGINE)



MAX CONC = 4.56 ug/m3
(Background Not Included)

FIGURE 17
COMPRESSOR ENGINE MODEL FOR NOX
(TWO ENGINES)

installed per township. If sufficient gas production occurs, a second compressor may be installed in the same township. With this distribution of compressor stations throughout the assessment area, it is unlikely there will be a significant contribution of emissions that would cause significant cumulative impacts.

Analysis by the WDEQ of the Encoal project and the Two Elk project for NOx emissions indicate 1.67 and .53 micrograms per cubic meter maximum modeled annual impact respectively. If one or more compressor stations were to be located so the isopleths from each facility overlapped, there would be a cumulative impact. As previously described, this is not likely to occur.

No background concentrations are available for carbon monoxide since it is normally not a problem in northeast Wyoming and no regional, long-term monitoring has been conducted. Wyoming and National ambient air quality standards are 40,000 micrograms per cubic meter for a one-hour period and 10,000 micrograms for an eight-hour period. Encoal's maximum modeled concentrations were 181.4 (one-hour) and 37.4 (eight-hour); Two Elk maximum modeled concentrations were 72.07 (one-hour) and 15.07 (eight-hour); Gillette South maximum modelled concentrations were 87.57 micrograms per cubic meter for one hour and 78.81 micrograms per cubic meter for eight hours. These emission levels are all within the standards listed on table 12 in chapter 3 of this final EIS.

ERRATA

An appendix has been added to this final EIS showing individual graphs of existing BLM monitor wells.

On page 66, first paragraph, line 6, should read, "impacts **from CBM wells** (five . . . ."

On page 68, under "Changes in Groundwater Quality," the third line should read, "; there are no foreign materials being introduced **directly into** the system."

On page 70, the first paragraph, the last two sentences are replaced with the following paragraph.

> **As part of a cooperative agreement signed in 1993 between WDEQ, BLM, the Office of Surface Mining (OSM), the University of Wyoming, the WSEO, and the Wyoming State Geological Survey, a groundwater drawdown model was developed to predict the extent of the five-foot drawdown in the Wyodak coal as a result of anticipated coal bed methane development and coal mining in the Powder River Basin. As a test of this model, cumulative drawdown in the Wyodak coal as a result of existing mining and potential coal bed methane development in the Little Thunder Creek drainage was modeled for the years 1977 through 2021. The Little Thunder Creek drainage includes Jacobs Ranch, Black Thunder, and North Rochelle mines. A report on the result of this pilot modeling project has been prepared by the cooperators and is currently undergoing editing following a review by the three mines involved. This report will be available to the public after the review and editing process is completed. The results of this study were presented at the 14 annual National Meeting of the American Society of Surface Mining and Reclamation (ASSMR) in Austin, Texas in May 1997. A summary of the results were published in the proceedings volume from that meeting (Peacock 1997). The pilot study did not consider the impacts of mining the North Rochelle of Thundercloud lease-by-application (LBA) tracts, or drawdown from mines outside the Little Thunder Creek drainage but did consider mining all existing leases in the drainage including the previously issued Jacobs Ranch and West Black Thunder LBAs.**

Add to page 78, under "Surface Water," as the last paragraph before the "Wildlife" section, the following, **"No serious problems have occurred to date, and it has been generally well received by the landowners. The discharged water helps fill and maintain water levels in stock ponds, supports vegetation production, and provides wildlife habitat along the receiving streams."**

On page 79, under "Raptors," line five, should read, "... or collision fatalities. **Construction design or** burying **distribution** lines would eliminate these fatalities."

On page 80, under "Vegetation Resources," add after the last sentence: **"The installation of 20 pairs of monitoring wells will temporarily disturb five acres. This will affect one animal unit month (AUM) for one year of disturbance."**

On page 88, the second paragraph, the first sentence should read, ". . . , the BLM would require operators to offer **potentially affected** landowners . . . ."

On page 109, Figure 13, PM_{10} concentrations are $\mu g/m^3$.

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CHAPTER 5

CONSULTATION AND COORDINATION

SCOPING PROCESS

The CEQ regulations require an "early and open process for determining the scope of issues to be addressed and for identifying significant issues related to a Proposed Action" (40 CFR 1501.7). Scoping was conducted through a direct mail process and public meetings. The mailing list included landowners, business groups, environmental groups, and any other interested members of the public.

Public scoping meetings were held on March 12, 1996 at the Casper District Office and on March 25, 1996 at the Holiday Inn in Gillette. All substantive comments BLM received during these meetings have been used to direct the scope and analysis of this EIS. Public scoping comments were accepted through April 8, 1996, and a decision letter stating the BLM's intent to prepare an EIS was sent to the agencies and public on the mailing list on May 7,1996. The notice to prepare an EIS appeared in the *Federal Register* on May 28, 1996.

Additional meetings were held to develop a hydrologic mitigation plan on December 13, 1995 and January 23, 1996 at the Towers West in Gillette. These first two meetings included potentially affected landowners, federal and state agency personnel, and six CBM development companies. A working group of affected landowners and industry representatives was formed from those two meetings to address the hydrologic issues of water well drawdown. Meetings of this group continued through September 1996. These meetings resulted in the Water Well Agreement in the appendix of the draft EIS.

PUBLIC REVIEW OF DRAFT EIS

On March 28, 1997, the Environmental Protection Agency's Notice of Availability was published in the *Federal Register*. Over 450 copies of the draft EIS were made available to the public and interested agencies for a 45-day public comment period. The date by which the comments had to be received was May 12, 1997. On April 18, 1997, a Notice of Availability was published in the *Federal Register*.

DRAFT EIS COMMENTS

A total of 12 comment letters were received during the 45-day public comment period provided on the draft EIS. Responses to public comments received on the draft EIS are included in this final EIS. Comments are numbered sequentially within a letter and correspond to the numbered response.

Major issues of public concern were as follows.

— People were concerned with the loss of hydraulic head related to groundwater associated with the coal seam. Concerns related to lowering of water levels and increased pumping costs because water would have to be pumped from greater depths.

— Concerns were voiced on how the differentiation would be made between coal mine- caused and CBM-caused impacts to the lowering of the water in the coal seam. How would the responsible entity be identified?

— Questions were posed on what effects the proposed action would have on air quality. Of concern were possible hazardous emissions and pollutants released as a result of compressor emissions.

— Disposing water on the surface raised concerns about water quality due to possible increased erosion and possible weed infestations because of water flow fluctuations.

— Questions were raised about the use of produced water for dust control, stock watering, and the creation of wetlands. What were the ramifications of using this water in this manner?

— Concern was voiced that the mines had been venting methane for years and now we had companies working to recover the methane and pay royalty on production. Were we going to make the mines pay back royalty and future royalty for the methane they vent?

— Commentors were concerned that we had not done further modeling to predict possible drawdowns and impacts.

— Concern was voiced about the use of the 1988 CHIA ("Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming") and how this affected cumulative impacts.

— Concerns were voiced that previous documents had underestimated the magnitude of impacts when in actuality we had underestimated rate of impact occurrence.

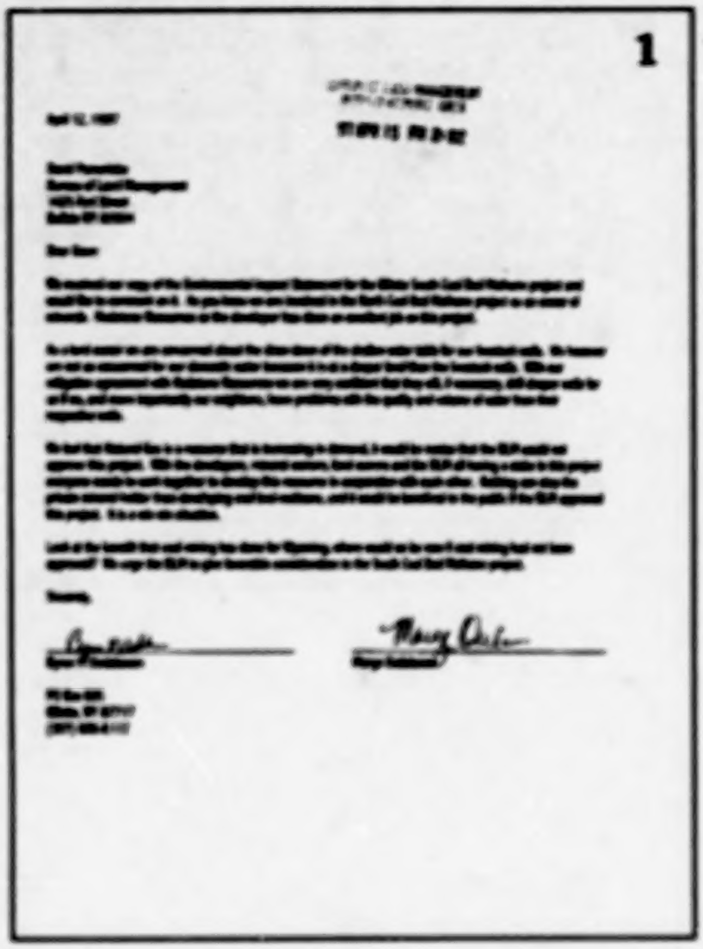
— Concerns were raised that we had not addressed impacts to threatened and endangered species, raptors, and fisheries.

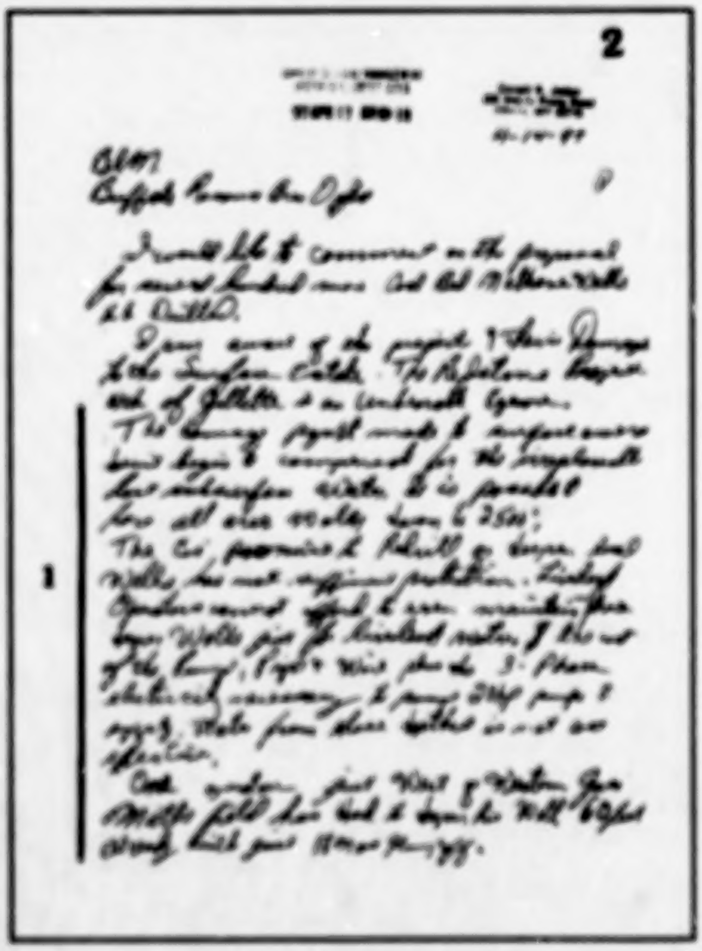
Additional analysis and/or specific changes (errata) in the text of the draft EIS are found in each chapter of this final EIS. Where a response to a comment indicates "see Errata" or "see additional analysis," the "Errata" section of a particular chapter of this final EIS should be consulted for the specific rewording or clarification of the text.

COMMENT LETTERS RECEIVED ON THE DRAFT EIS

Introduction

The following 12 comment letters were submitted by the public and interested agencies during the 45-day comment period and shortly after the formal comment period closed on the Gillette South Coal Bed Methane Project Draft EIS. All comment letters received have been reproduced in this section with each letter given a unique identifying number. Comments containing only opinions or preferences did not receive a formal response; however, they will be considered and included as part of the BLM decision making process. Substantive comments requiring a response are identified by comment number associated with heavy vertical lines in the margin of each letter. For instance, comment 3-2 is the second comment on comment letter number 3 requiring a response. All responses are presented in the following section. Each response identifies the letter and comment number that it is associated with.





Comment Responses

Response to Letter 1, Byron and Marge Odekoven

Thank you for your interest in the coal bed methane EIS process.

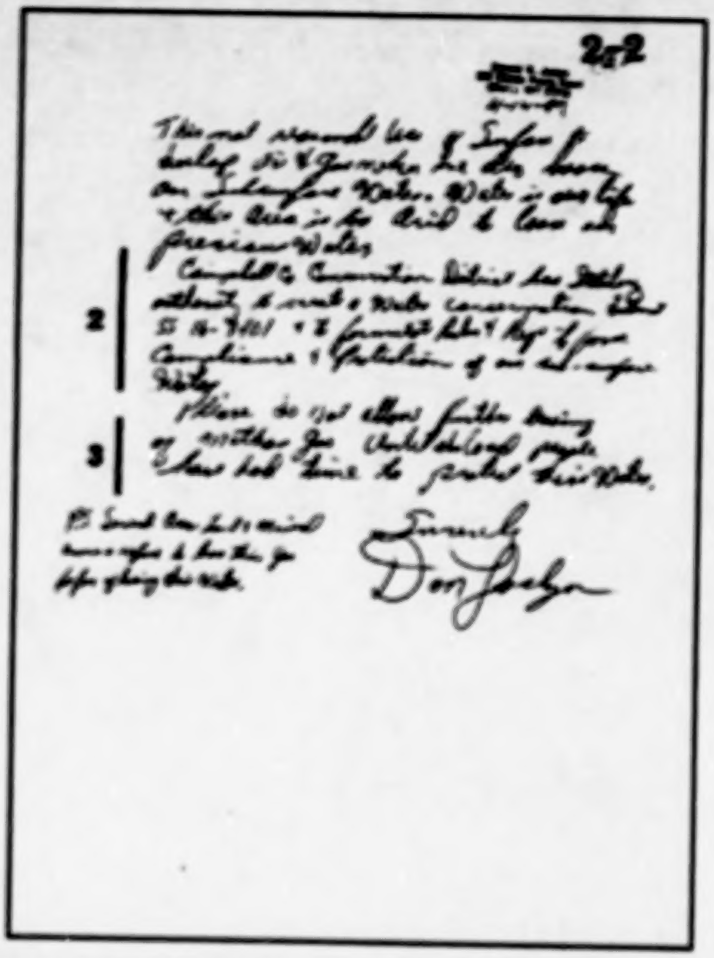
Response to Letter 2, Donald R. Joslyn

Thank you for your interest in the coal bed methane EIS process.

1. Our data does not indicate that it is possible for all subsurface water down to 2,500 feet to be lost through coal bed methane or coal development. The maximum depth of the target formation (Wyodak/Anderson coal) in the Gillette South assessment area is less than 1,500 feet. This is on the extreme western edge of the area where the formation is at its' deepest. No subcoal (or underburden) impacts to water resources have been documented to date. In addition, no impacts to aquifers not immediately adjacent to the coal (above) have been documented. We are planning to continue monitoring on the shallower sands and have plans to initiate monitoring on selected underburden wells in the near future to ensure protection of these waters.

   Prior environmental documents we have done and this draft EIS all have predicted that the hydraulic head of water in wells completed in the coal seam would be temporarily reduced (lowered) or eliminated with the coal bed methane activity.

2. Counties do have statutory authority to establish water conservation districts. This must be done according to state law in coordination with the WSEO.



2-2

This coal [illegible] use of Surface [illegible] [illegible] [illegible] [illegible] Water. Water is our life & this area is [illegible] arid [illegible] precious Water.

2 Campbell Co. Conservation District has statutory authority [illegible] & Water conservation [illegible] 11-16-3101 [illegible] Compliance & Protection of [illegible] Water.

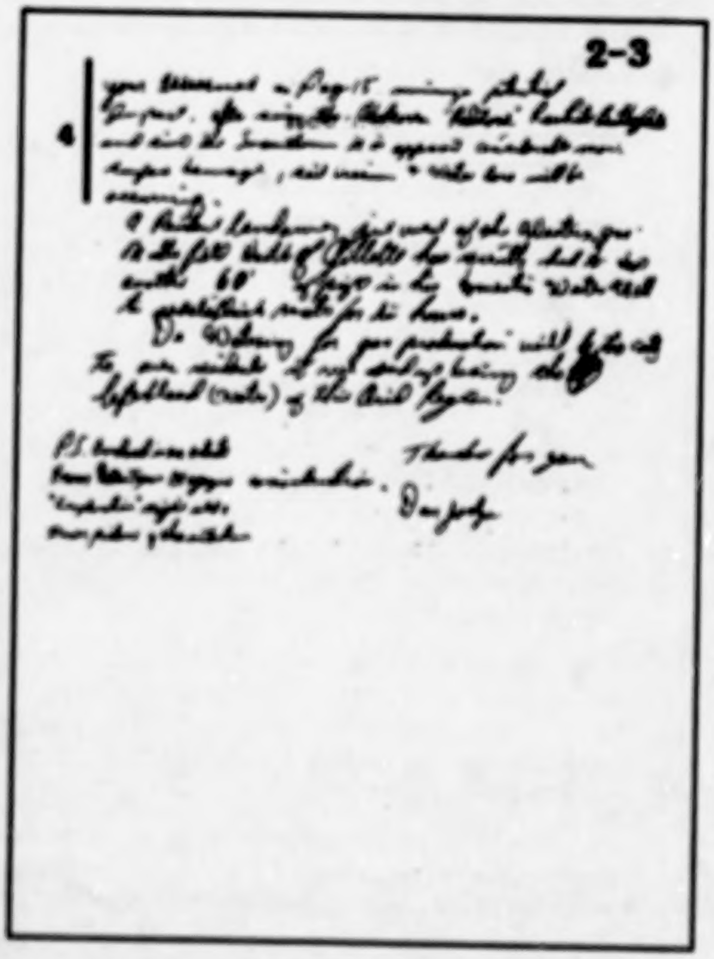
3 Please do not allow further drilling [illegible] [illegible] have had time to protect their Water.

P.S. [illegible]

Sincerely,
Don [illegible]

Comment Responses

3. Virtually all of the federal lands involved in the EIS assessment area are already covered by existing oil and gas leases. As part of the mitigation proposed by the draft EIS (page 87 and 88) and included in the final, coal bed methane operators will be required to offer all potentially affected landowners the opportunity to sign a water well agreement, contained in the appendix of the draft EIS, as part of the federal APD approval process.



2-3

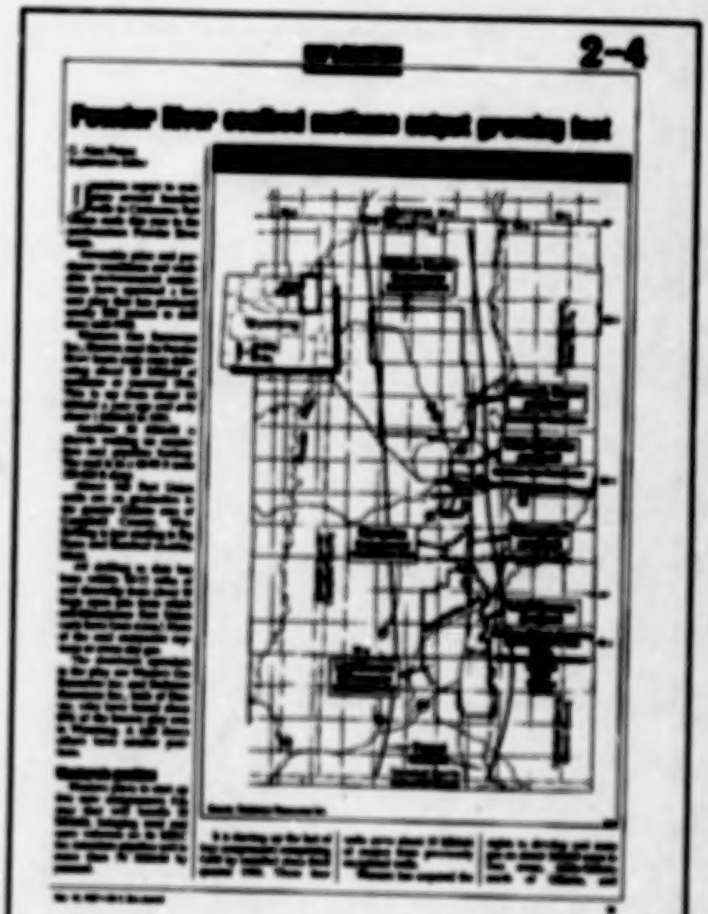
4 Your statement on Page 15 [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] 60' [illegible] Water [illegible]

[illegible] of the [illegible]

P.S. [illegible]

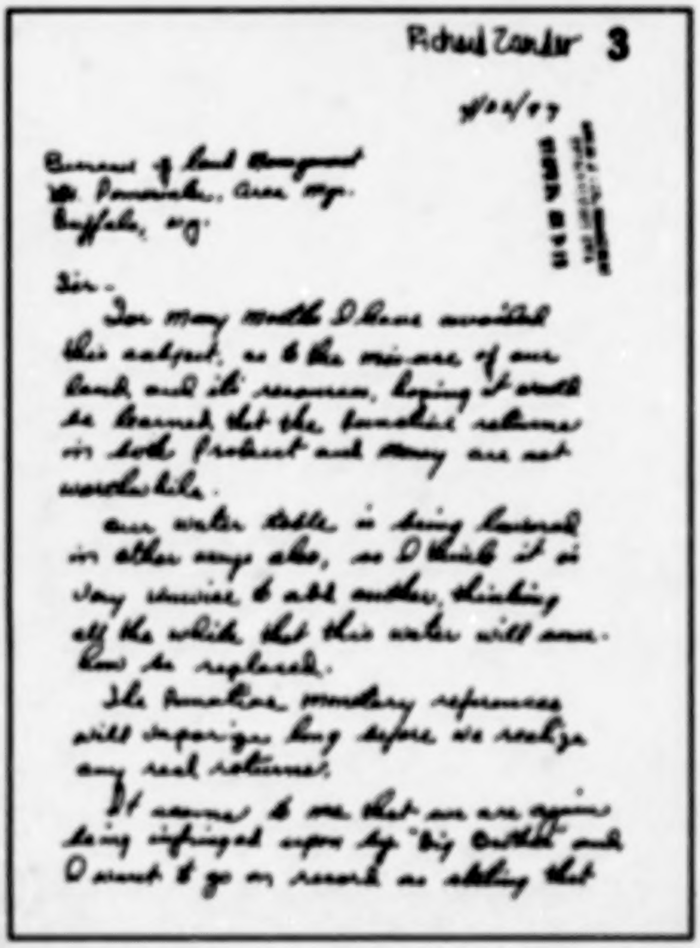
Thanks for your [illegible]
Don [illegible]



2-4

Powder River coalbed methane output growing fast

2-5



Richard Zander 3

9/22/97

Bureau of Land Management
Mr. Dominick, Area Mgr.
Buffalo, Wy.

Sir -

For many months I have avoided this subject, as to the misuse of our land and its resources, hoping it would be learned that the temporary solutions in both product and money are not worthwhile.

Our water table is being lowered in other ways also, so I think it is very unwise to add another, thinking all the while that this water will never be replaced.

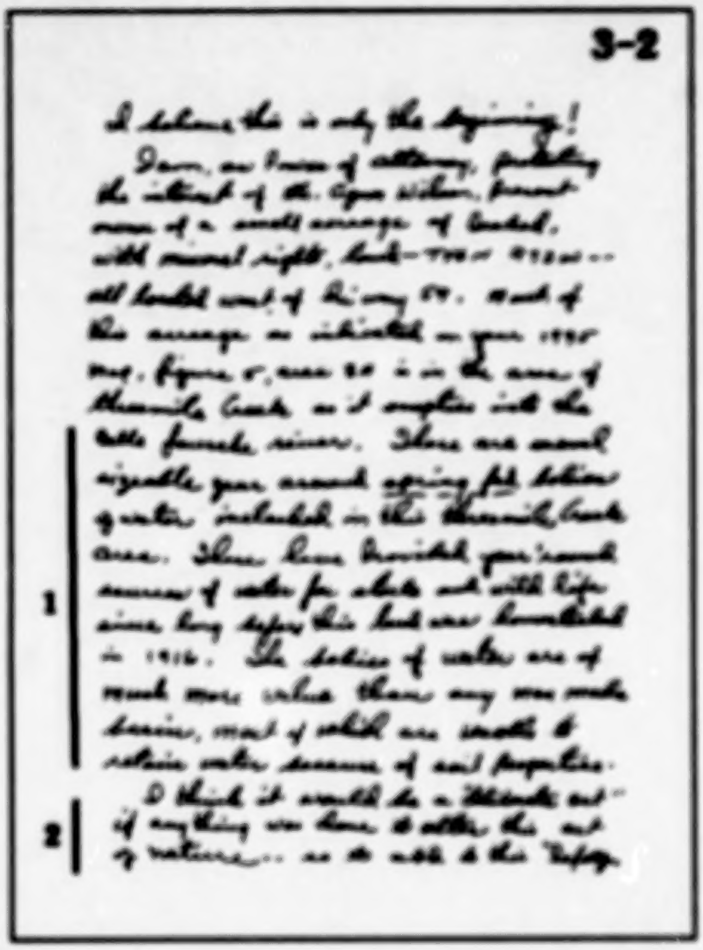
The temporary monetary references will evaporate long before we realize any real returns.

It seems to me that we are again being infringed upon by "Big Outfits" and I want to go on record as stating that

Response to Letter 3, Leonard Straatsma

Thank you for your interest in the coal bed methane EIS process.

1. The springs and/or springfed bodies that are referred to here are either local shallow systems or related to the shallower Felix coal seams and their associated clinker outcrops. These systems should not be affected by the lowering of the water levels in the CBM target formation (Wyodak/Anderson coal) as there is significant separation between the two formations (>400 feet) in this area.
2. A variety of mineral ownerships exist in this area and throughout the assessment area. The BLM has no control over what the private and state mineral estate owners choose to do with their minerals. On the federal minerals which exist in the vicinity of this estate, oil and gas leases already exist. A private mineral owner has the option to lease or not lease. The BLM will work to ensure the springs in the area are protected.



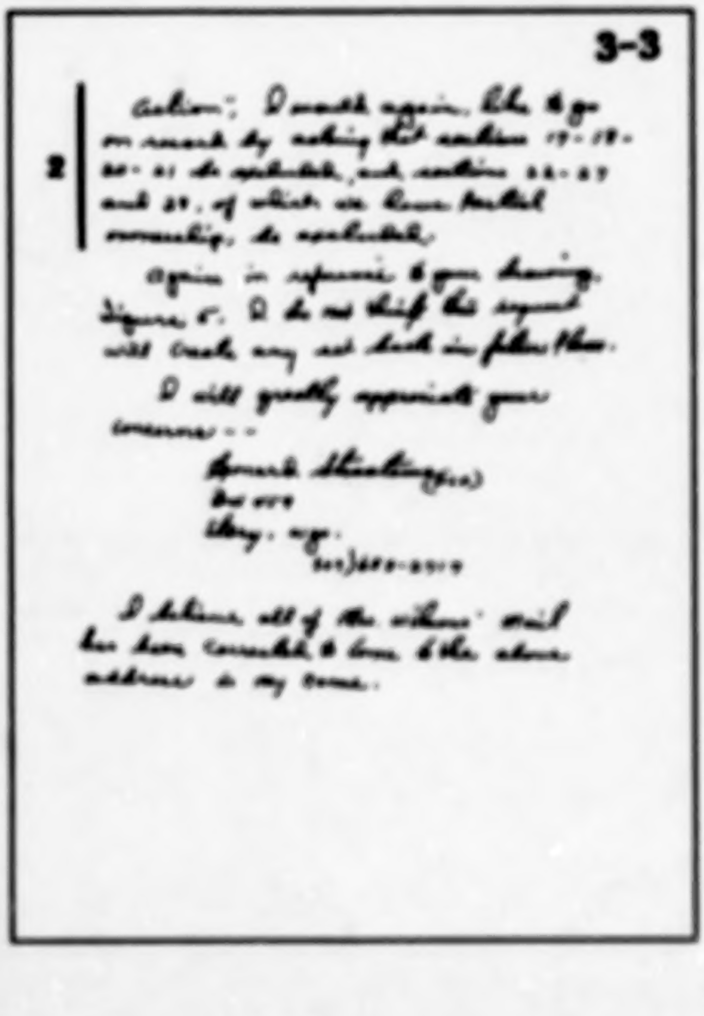
3-2

I believe this is only the beginning!

I am, as heir of [illegible], probably the [illegible] of the [illegible], present owner of a small acreage of land, with mineral rights, [illegible] — T[illegible] R[illegible] — all located west of Highway 59. Most of this acreage is indicated on your 1985 map, figure 5, area 20 & is in the area of [illegible] Creek as it empties into the

1 Belle Fourche River. There are several sizeable year around spring fed bodies of water included in this [illegible] Creek area. These have provided year around sources of water for stock and wild life since long before this land was homesteaded in 1916. The bodies of water are of much more value than any man made dams, most of which are unable to retain water because of soil properties.

2 I think it would be a [illegible] act if anything was done to alter this act of nature — as it adds to this Refuge



3-3

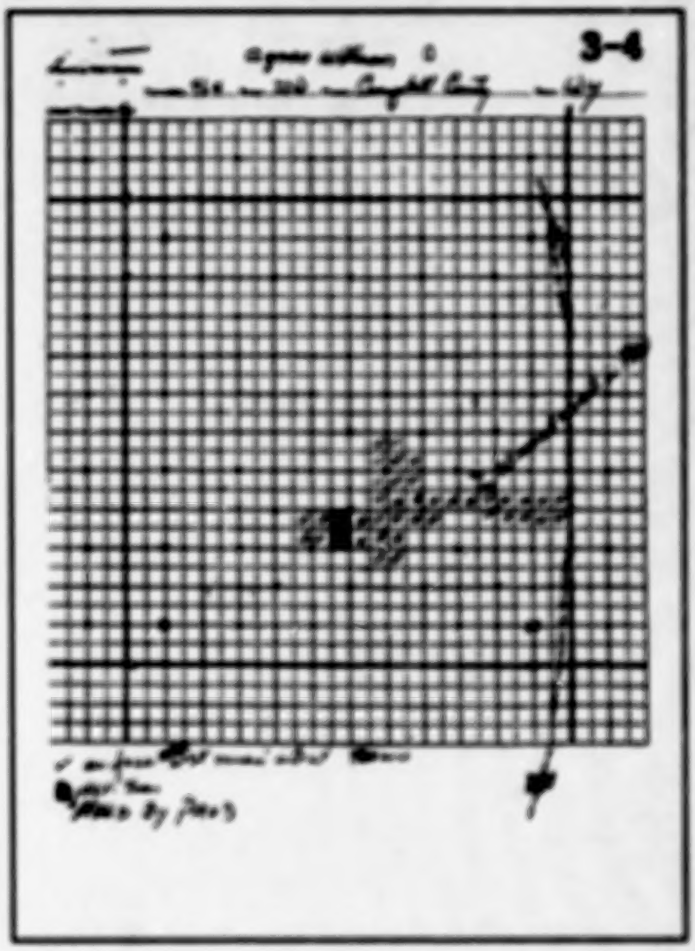
2 action; I would again like to go on record by asking that sections 17-18-20-21 be excluded, and sections 22-27 and 28, of which we have partial ownership, be excluded.

Again in reference to your drawing, figure 5. I do not think the [illegible] will create any [illegible] in [illegible].

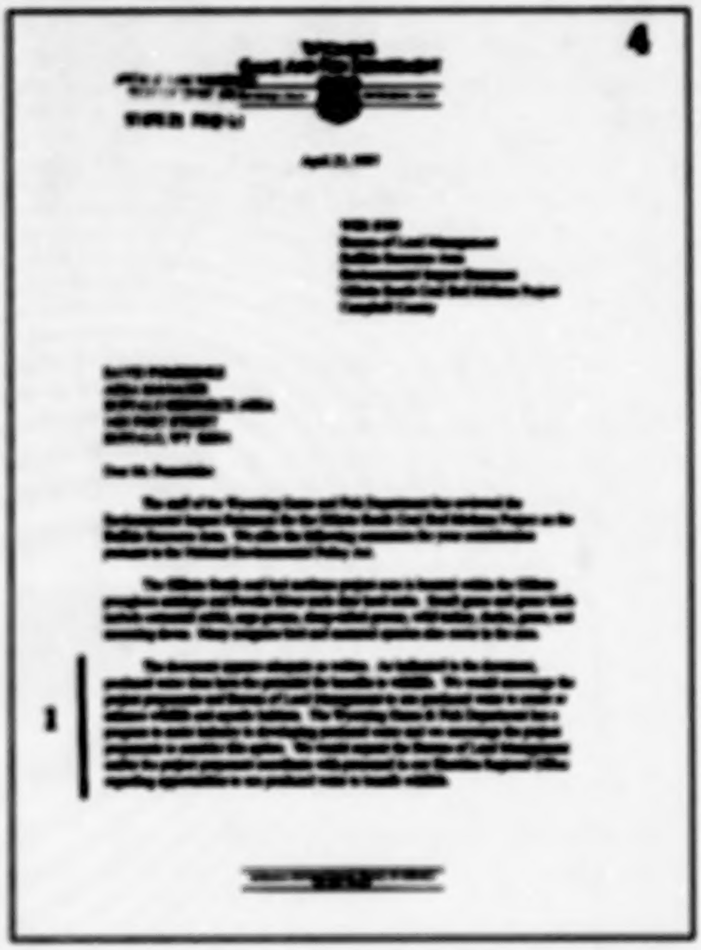
I will greatly appreciate your concerns - -

[illegible] [illegible](Mrs)
Box [illegible]
[illegible], Wyo.
[illegible])[illegible]-[illegible]

I believe all of the others' mail has been forwarded to here to the above address in my name.



3-4



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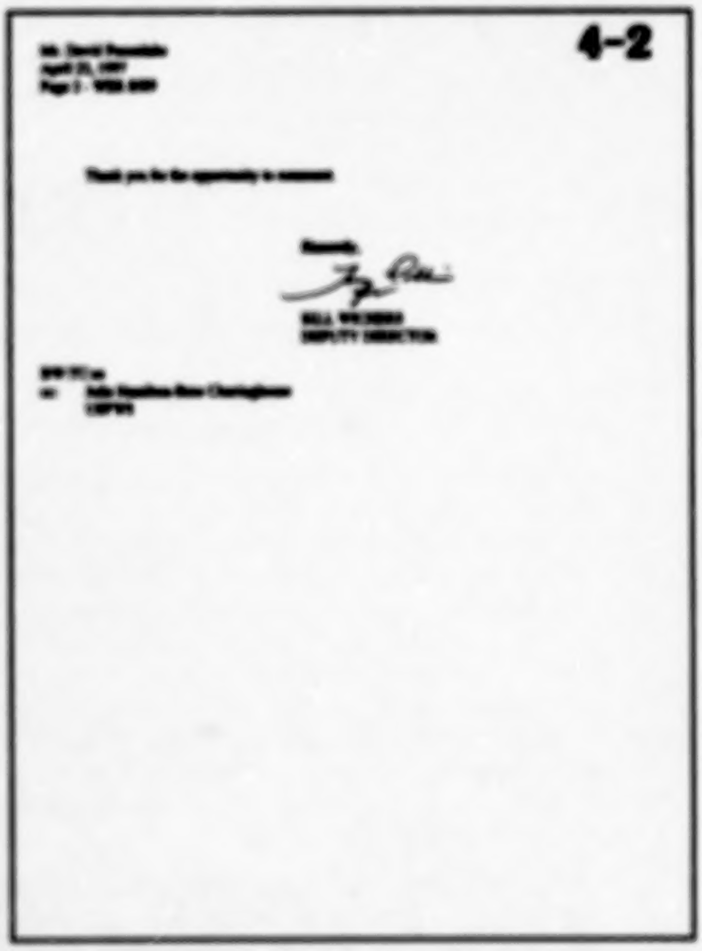


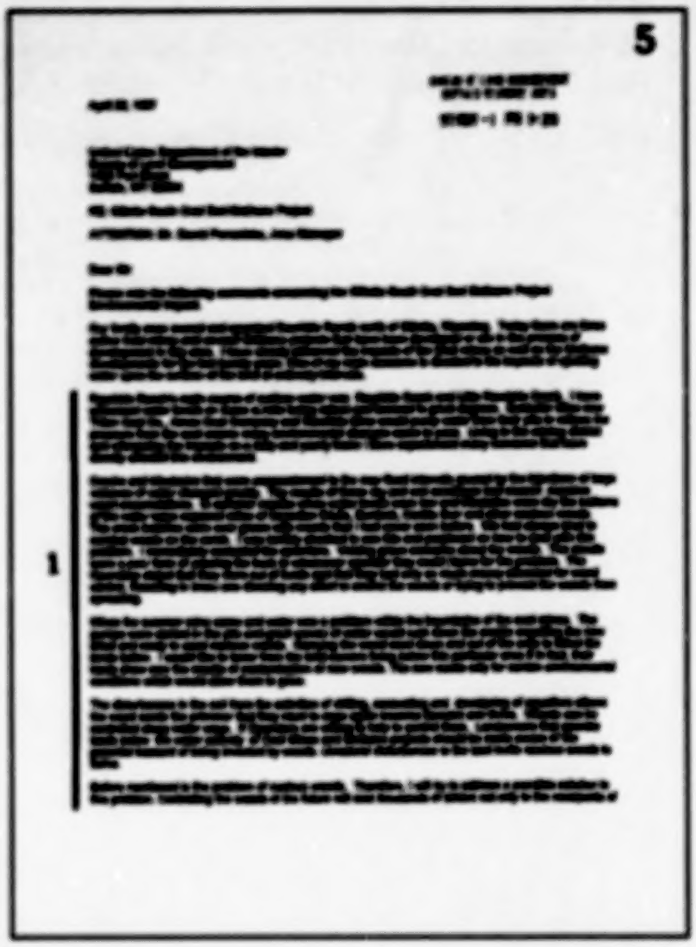
4-2

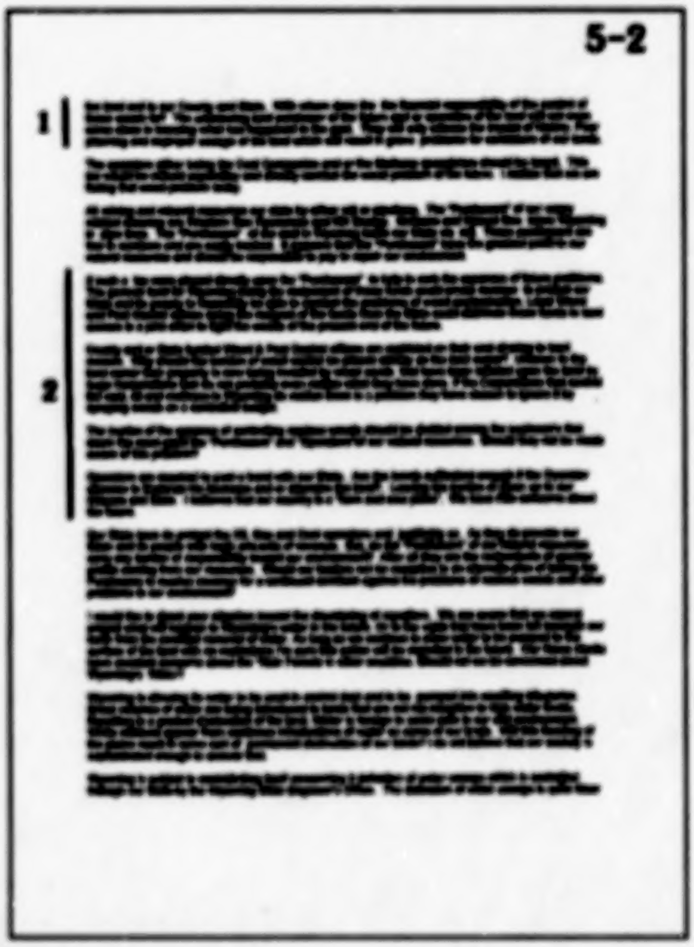
Comment Responses

Response to Letter 4, Wyoming Game and Fish Department

Thank you for your interest in the coal bed methane EIS process.

1. The BLM has and will continue to urge companies to avail themselves of this opportunity. Of note, a number of landowners have taken it upon themselves to establish wetland and fisheries habitat with the produced water along with using water discharge points to improve their livestock distribution patterns.



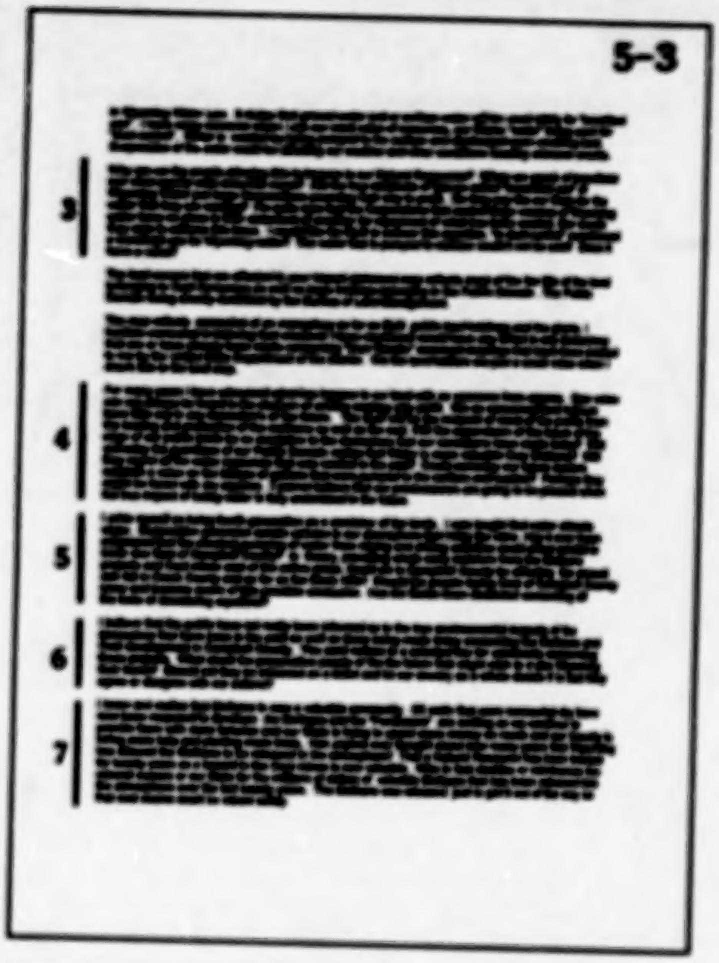


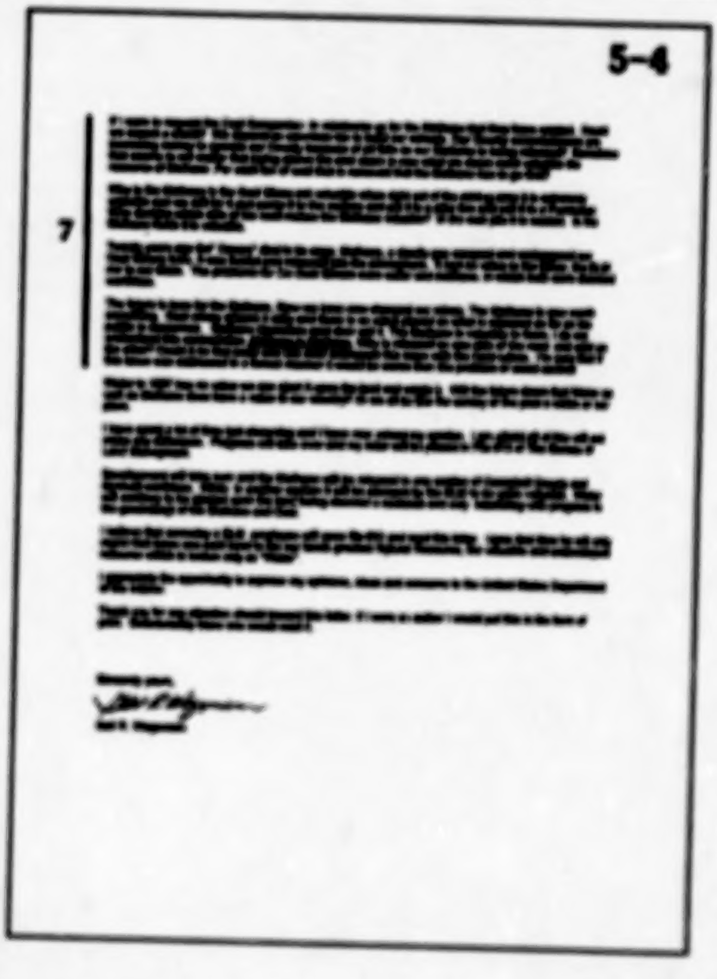
Comment Responses

Response to Letter 5, Gail R. Wagensen

Thank you for your interest in the coal bed methane EIS process.

1. The concern expressed about weeds and their dispersion along the stream channels is a valid concern. As described by the commentor and from a biological standpoint, the plants described typically are invader species which establish themselves where disturbance has occurred. Where stream flows fluctuate greatly, native vegetation is removed and bare soil is exposed to the invasion of these species. As described, the mines do discharge large amounts of water on a periodic basis such as after large rainstorms, which leads to the flow fluctuation and subsequent removal of native species. Coal bed methane operations are typically a constant, low flow discharge with minimal streamflow fluctuations. BLM will consult with WDEQ and the Office of Surface Mining on this issue where there are discharges from both mining and coal bed methane. Where no mine discharge is involved, BLM will require CBM operators on federal minerals to monitor their discharges and eliminate problem species if they occur.
2. The BLM does require operators to control weed species on and around their oil and gas operations, and we will continue to do so. Where private and state minerals are involved we have no control. Perhaps the state or county would be the proper entity to address this problem.
3. Dust control at the mines around Gillette is a practice required to meet air quality standards for fugitive dust emissions. This is considered a beneficial use of the water by the WSEO if the mine has a water appropriation for this purpose. The water does have a value for the purpose for which it was appropriated. It could be sold if there were a willing buyer for the water.
4. The economic impacts of the project are detailed on pages 84 through 86 of the draft EIS. Additional analysis was done and is included in this document in chapter 4.
5. For the question regarding the potential of the effects of evaporation/rainfall, if we assume a worst case scenario of 640 wells at 20 gpm, a discharge of approximately 21,000 acre-feet per year would occur. Spreading this over the approximately 100 townships between the Gillette South assessment area and the South Dakota border results in an average increase in precipitation of 0.11 inches. This is assuming that 100% of the discharge evaporates and is precipitated within Wyoming east of the project—a worst case scenario. It is unlikely that any climate and/or precipitation change will result from this.
6. We sent out approximately 450 draft EIS documents to the public, sent out press releases to newspapers, television, and radio stations, and published the avail-

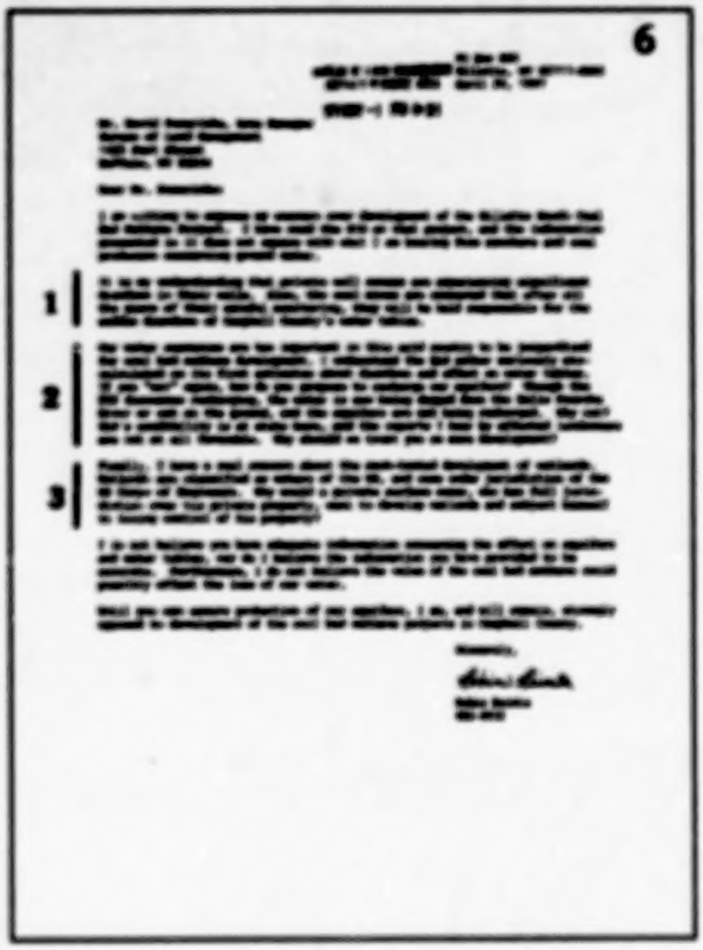




Comment Responses

ability of the document in the Federal Register. These efforts were to get the widest dissemination possible on the document.

7. Coal bed methane development in the Powder River Basin is a relatively new technology. Before this technology was developed, there was no way to recover the methane which was vented to the atmosphere as a result of coal mining. As coal bed methane technology develops, oil and gas companies are moving to recover the methane before mining. The mining probably has a beneficial impact on the successful recovery of the methane which is probably why the first successful development occurred by the Rawhide coal mine.



Comment Responses

Response to Letter 6, Robin Reints

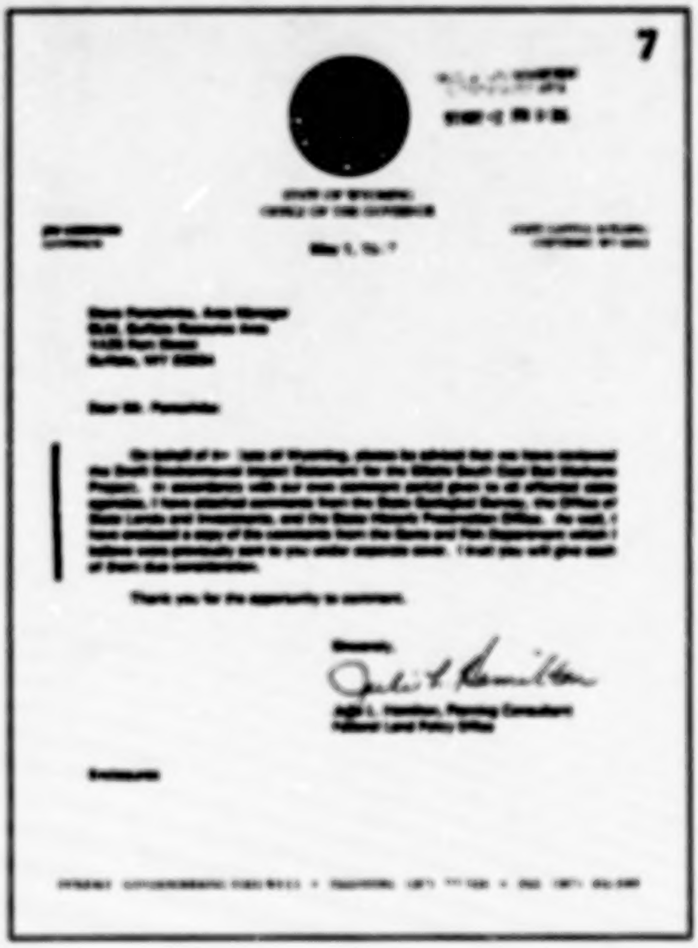
Thank you for your interest in the coal bed methane EIS process.

1. Prior environmental documents BLM has done and this draft EIS all have predicted that the hydraulic head of water in wells completed in the coal seam would be temporarily reduced (lowered) or eliminated with the coal bed methane activity. The WSEO has instituted monitoring requirements of the CBM operators as part of the their water well permit process. The BLM has instituted an independent monitoring program to track what is happening both in the coal seam and the aquifers above and below the coal. This information and the formation of a combined data base proposed on page 88 of the draft EIS will enable BLM and the WSEO to develop a comprehensive picture of what is occurring.

2. The error on the impacts caused by the Marquiss and Lighthouse projects was not in total impact but rather in the rate at which the impact occurred. We assumed a drilling and discharge rate commensurate with that ongoing at the time of our analysis. As it turned out the development and discharge rates increased as technology evolved and development rates increased. This resulted in impacts occurring faster than predicted. This will not change the predicted maximum impact.

   We have been continuously monitoring the discharge of the Belle Fourche River below the project areas (above the Cordero Mine) since the initiation of the Marquiss CBM project. There has not yet been any measurable increase in the discharge of the Belle Fourche attributable to the discharge of water associated with the production of coal bed methane. The rate at which the discharge water is being used, recharging shallow aquifers (infiltrating), and evaporating has been greater than or equal to the discharge rate to date.

3. Wetlands created as a part of this project do not come under the jurisdiction of the U.S. Army Corp of Engineers or the FWS. Only if an existing wetland is enhanced and then impacted do these agencies have an input.



7

Comment Responses

Response to Letter 7, State of Wyoming

Office of the Governor

1. Thank you for your close cooperation in the development of coal bed methane. BLM will work to continue this close relationship.

Wyoming Division of Cultural Resources

1. The EIS is a disclosure document of predicted impacts. As projects are permitted, detailed inventories and analysis of the cultural resources will be conducted, additional Native American consultation will occur, and proper mitigation will be required as part of the permit approval process.

Wyoming State Geological Survey

1. Thank you for this information.

Wyoming State Land and Farm Loan Office

Thank you for your interest in the coal bed methane EIS process.

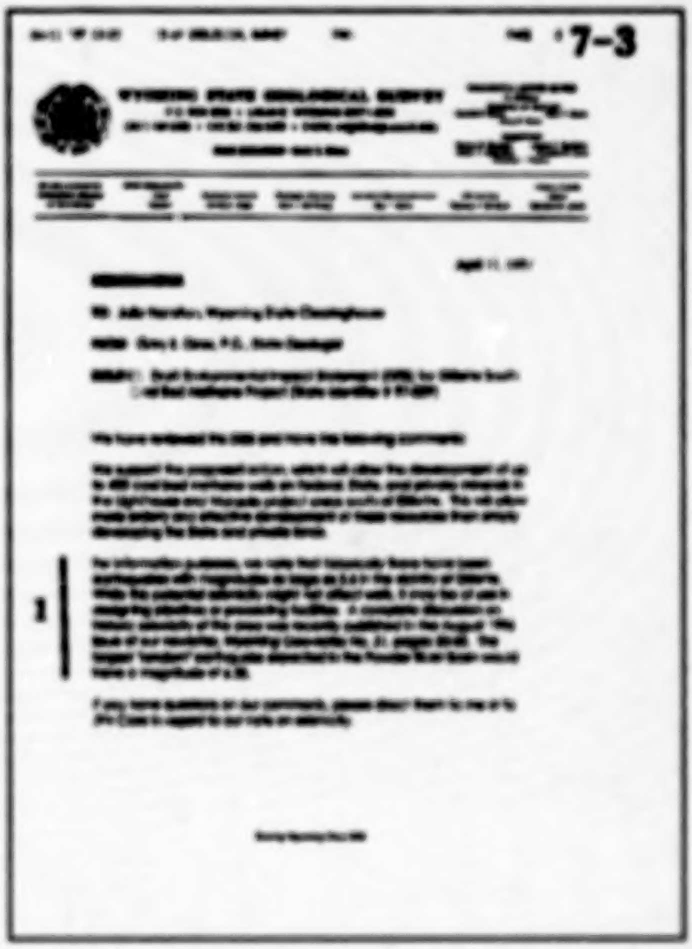
Wyoming Game and Fish Department

Thank you for your interest in the coal bed methane EIS process.

7-2

WYOMING

DIVISION OF CULTURAL RESOURCES



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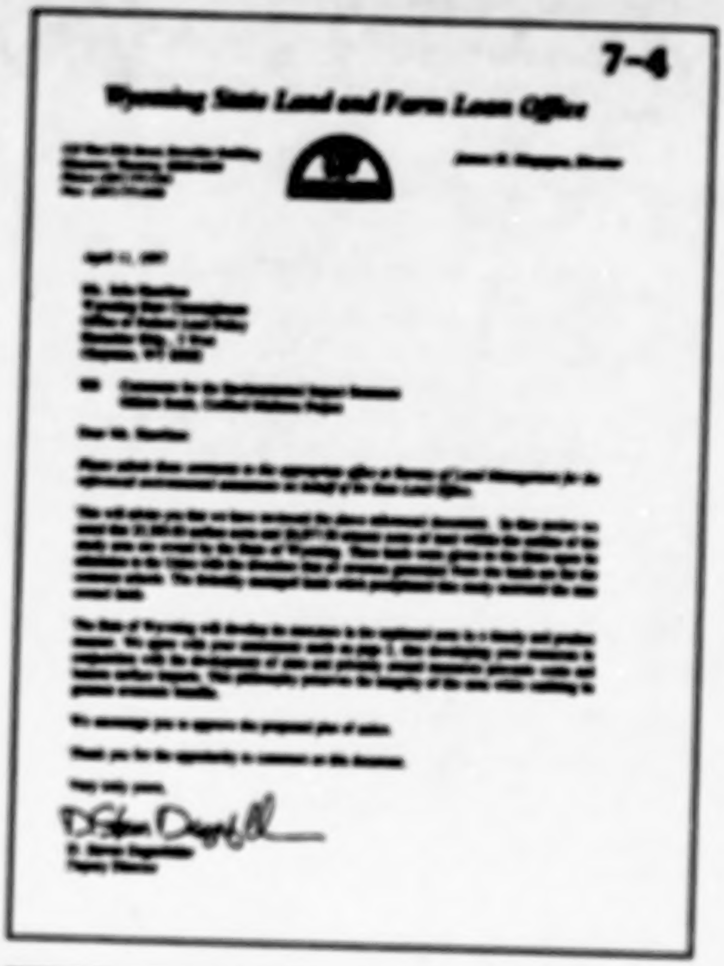

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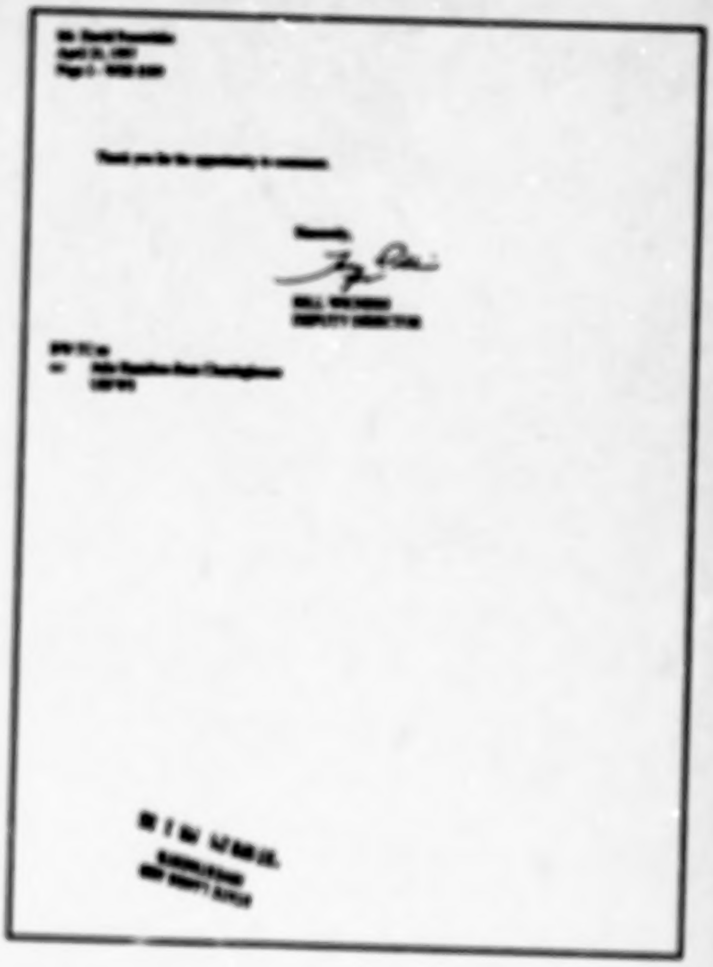
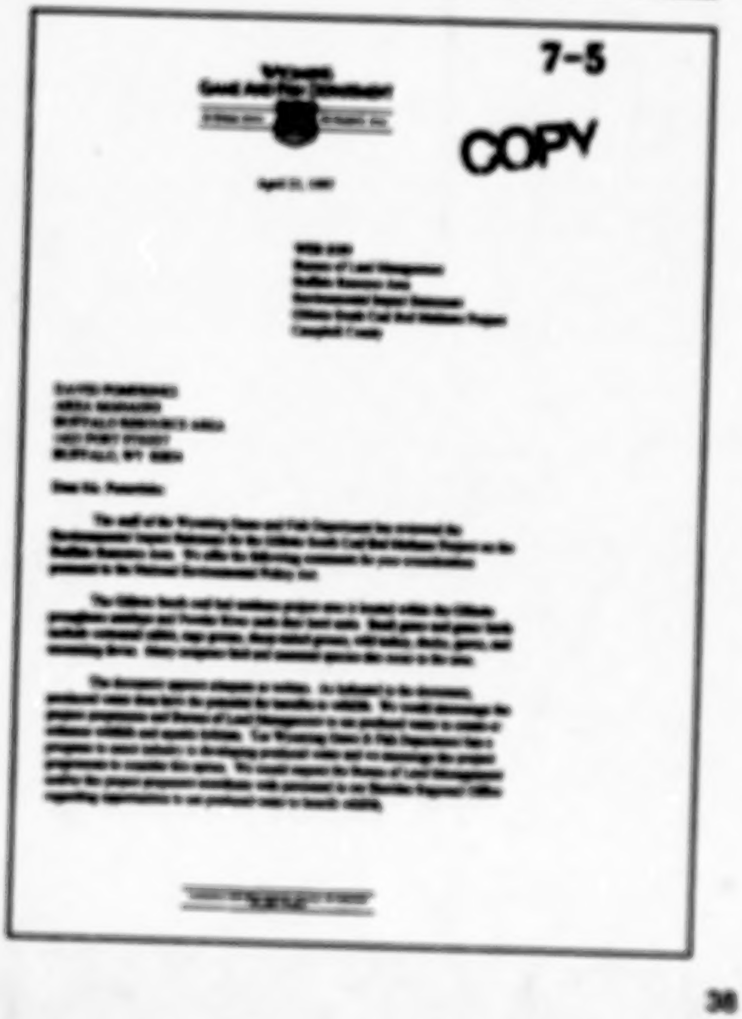
Wyoming State Land and Farm Loan Office





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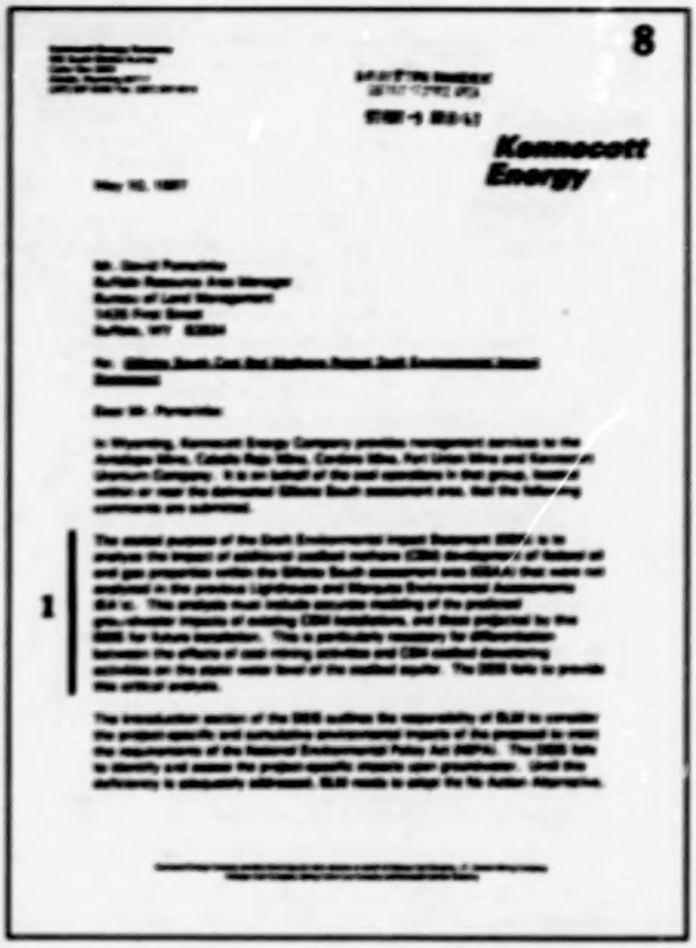

8

Kennecott Energy

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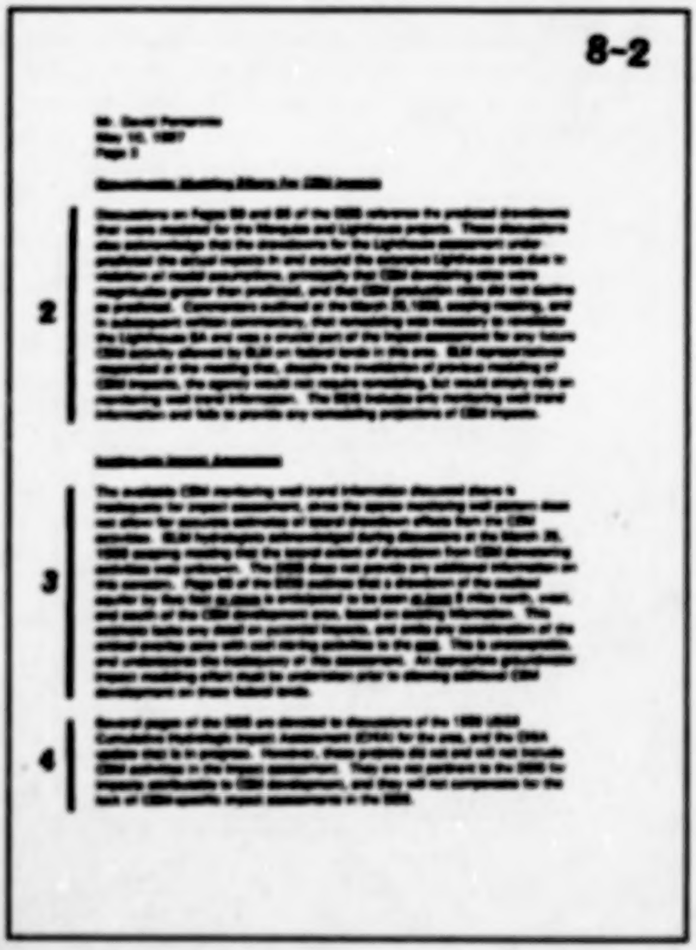

8-2

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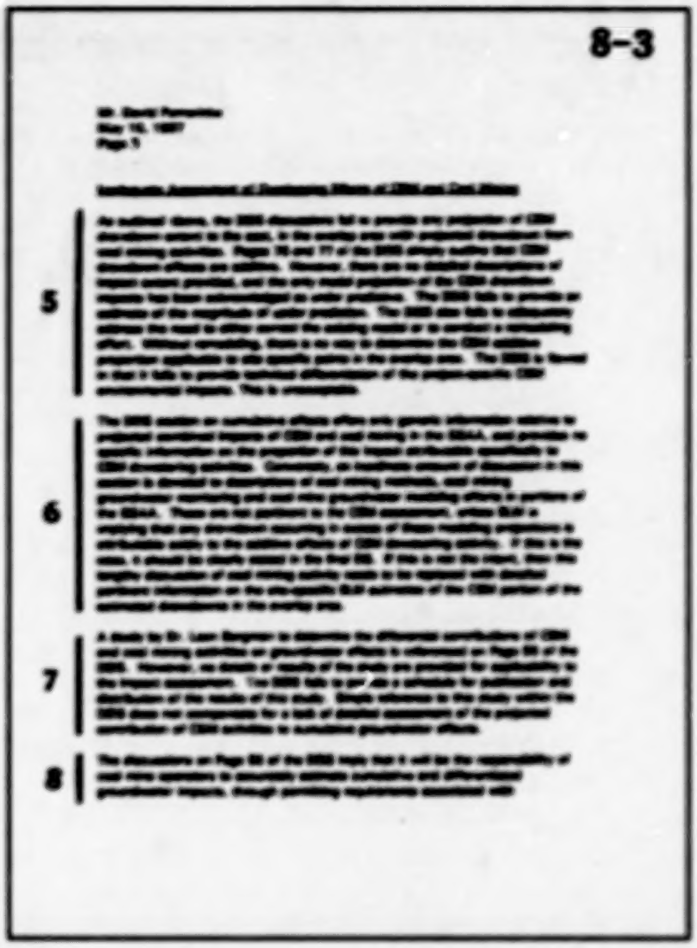
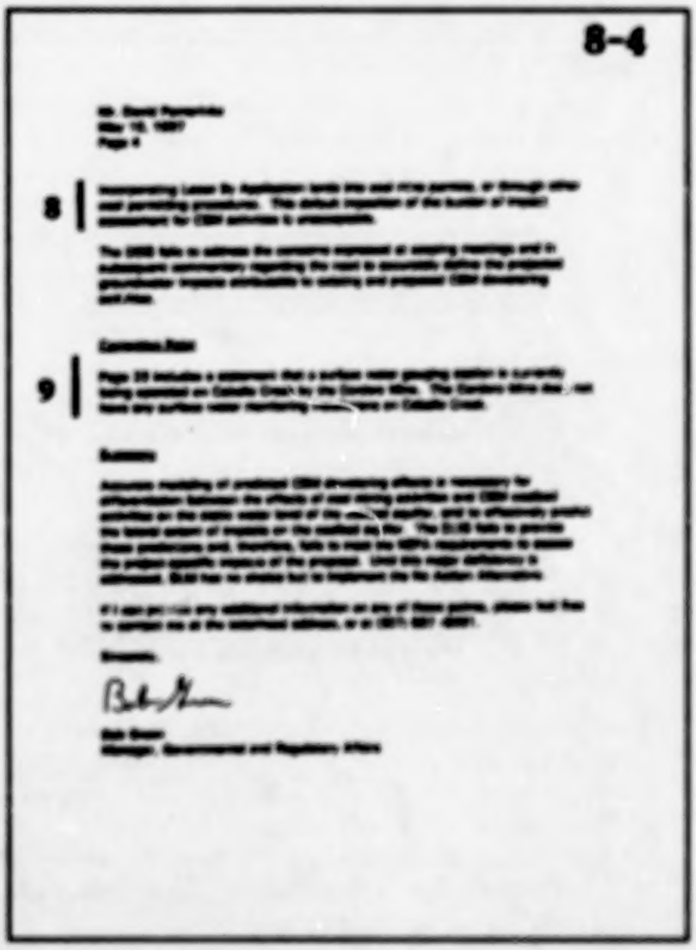
Comment Responses

Response to Letter 8, Kennecott Energy Company

Thank you for your interest in the coal bed methane EIS process.

1. When the BLM was doing scoping to determine what type of NEPA documentation we would do for the Gillette South area we disclosed to the public that we would not do any further modeling (letter of March 18,1996 and handout to the public at March 25, 1996 scoping meeting). Our reasoning for not doing any additional modeling was that from experience with existing models it was not feasible to credibly or accurately model an area as large as the Gillette South assessment area with existing data. As variables increase, accuracy decreases to the point where the model predictions become meaningless. BLM used what information we had, and we obtained the 15-year report from the Gillette Area Groundwater Monitoring Organization (GAGMO) to show what was happening as a result of mining. This information was used in the draft EIS. In addition, the monitoring identified in chapter 2 will help differentiate between the effects of coal mining and CBM development.
2. The actual impacts were not underpredicted but the development and discharge rates changed. This resulted in impacts occurring faster than predicted but will not change the predicted maximum impact. Also, please see the response to comment number one of this letter.
3. Yes, the existing monitoring network is inadequate to delineate the lateral extent of the impacts associated with CBM development. This is why we have proposed a substantial expansion of the monitoring carried out by the BLM in the Gillette South assessment area. With regard to the overlap area to the east, BLM assumed that it was a foregone conclusion that there will be significant lowering of the water in the coal between the mines and the CBM development (even to the point of complete dewatering). This will impact wells completed in the coal seam. Also, please see the response to comment number one of this letter.
4. The discussion is pertinent for the cumulative impact assessment as it provides background on what is occurring from the standpoint of the coal mines. We also state the impacts of mining and CBM will be additive in nature.
5. As stated in responses 1 and 3, BLM assumed that it was a foregone conclusion that there will be a significant lowering of the water in the coal seam between the mines and the CBM development. In fact, two of our easternmost monitor wells near the northern Lighthouse area have gone practically dry (partially due to increases in gas pressure).





Comment Responses

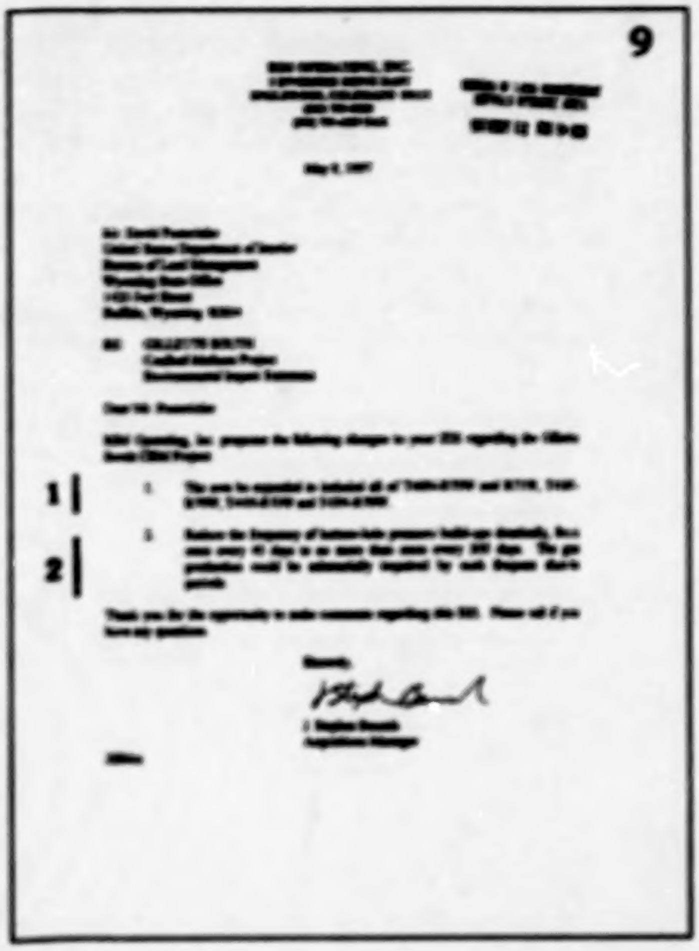
The results of the modeling were acknowledged as underpredictive. However, this was only with respect to the time in which the impacts would occur, not in the total impacts of the proposed Lighthouse project.

6. We believe we have presented a balanced view of what is occurring in and adjacent to the EIS assessment area. Coal is a major activity that has to be considered as part of the cumulative impacts assessment. A description of what development is occurring and what monitoring is taking place are presented to give the reader needed background information on all aspects of development. BLM tried to portray the impacts and stated that the groundwater impacts in the coal seam are additive in nature between coal mining and CBM development. BLM did not mean to imply that all impacts beyond the scope of the modeling result from CBM development. A large share of the cumulative drawdown will come from the proposed and existing CBM development but other activities such as coal mining will continue to have an impact. The draft EIS was to disclose impacts from all activities, not to imply responsibility.

7. The AML-funded study by Dr. Borgman is in progress. Various pieces of the study are complete and were used for the draft EIS. The document should be published by September 1, 1997. The intent was to verify assumptions used in the model being developed to predict impacts from CBM and coal development.

8. The statements concerning leases-by-application (LBA) and WDEQ, Land Quality Division are simply statements of fact about the LBA process. There is no intent here to "imply" responsibilities. This does, however, point out the differences between coal leasing and oil and gas leasing regulations.

9. This was a mistake on our part. It is the Coal Creek Mine that is currently having the Caballo Creek stream gauge operated by Intermountain Lab. Thank you for the information.

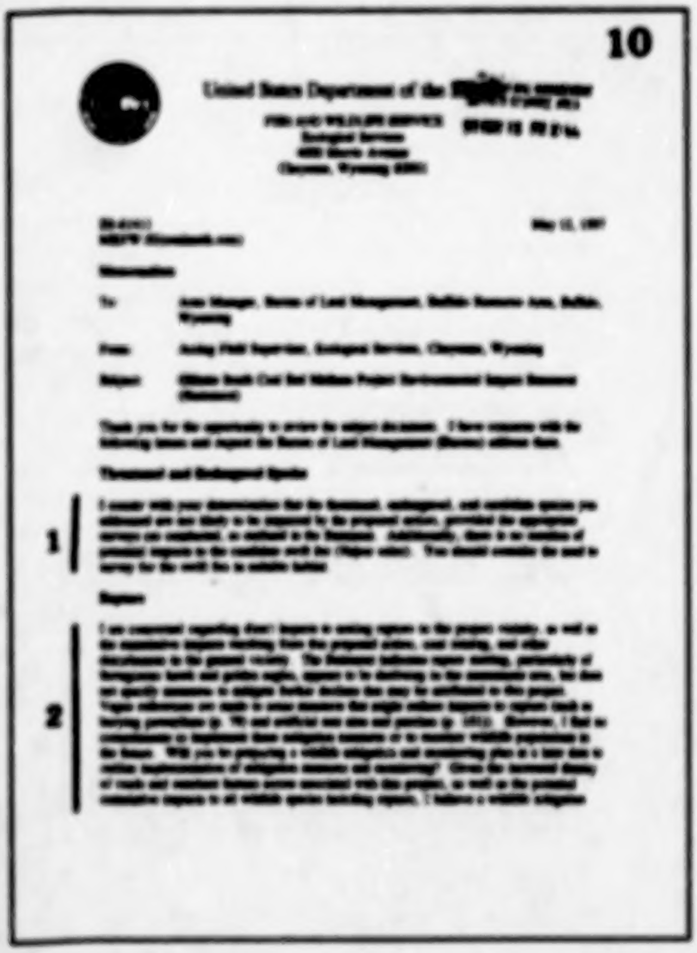


Comment Responses

Response to Letter 9, Rim Operating, Inc.

Thank you for your interest in the coal bed methane EIS process.

1. This request, which lacks any specifics, would require the addition of approximately three full townships to the EIS assessment area. To do so would require the BLM to reissue the draft EIS to provide an analysis of the effects of this additional acreage. This would result in a delay of four to six months. Additional acreage was added in this area at the request of industry during work on the draft EIS to accommodate additional expected development. BLM will not honor this request at this time. If your company is serious about development, they will need to present BLM with a substantive proposal that will be tiered off of this EIS.
2. This is a requirement of the WSEO as part of acquiring a water well permit for coal bed methane production.

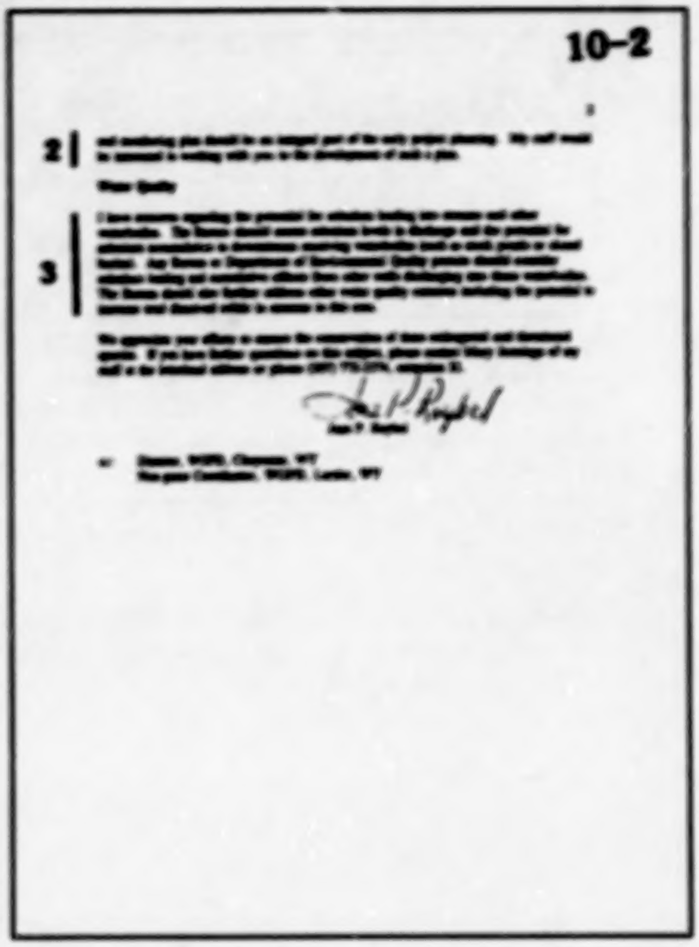


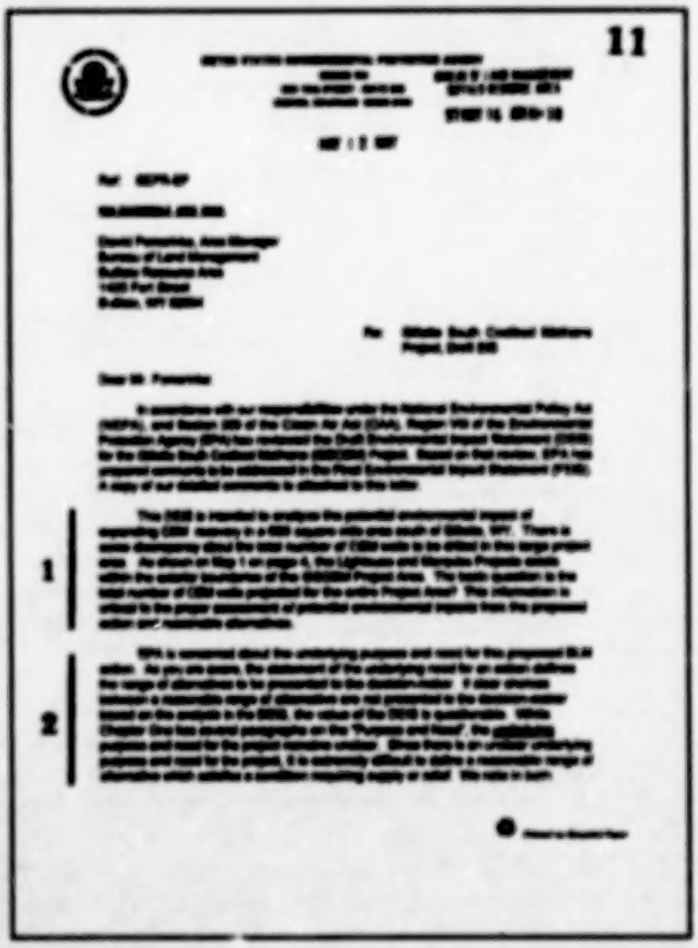
Response to Letter 10, U.S. Fish and Wildlife Service

Thank you for your interest in the coal bed methane EIS process.

1. Some limited surveys for swift fox have occurred in the southern reaches of the EIS assessment area on land administered by the U.S. Forest Service, and evidence of their occurrence was found. The BLM, in conjunction with the Forest Service, will carry out additional inventories to determine the extent to which swift fox occur in the assessment area.
2. Wildlife inventories to assess impacts to raptors are difficult to carry out in the EIS assessment area due to the lack of public surface and access. BLM, in cooperation with the Wyoming Game and Fish Department, did carry out an aerial survey of the assessment area in the spring of 1996 to identify nest sites. We plan on monitoring these nest sites each year.

   Six percent of the surface ownership is public and 41% of the oil and gas mineral estate is public. This mixed ownership pattern makes it difficult to identify and mitigate impacts from the coal bed methane development when wells are being drilled on all mineral ownerships. As part of the federal APD approval process, all wildlife concerns are addressed. When areas of concern such as nest sites are identified, the BLM requires the operator to abide by





appropriate mitigation measures to protect the nest site. This is normally a timing stipulation which precludes drilling during the crucial nesting period and may also include site-specific stipulations to preserve the integrity of the nest. Each action is site-specific as needs are identified. Actions cited in the draft EIS were meant to be illustrative in nature; not all inclusive of what we do. BLM would welcome your input on how raptors could be better protected given the mixed nature of the land pattern that we deal with.

3. Table 6, page 39 of the draft EIS, is an analysis of various trace mineral concentrations in groundwater from wells completed in the coal seam and shallower aquifers. Selenium loading was not found to be a problem.

Response to Letter 11, U.S. Environmental Protection Agency

Thank you for your interest in the coal bed methane EIS process.

1. The draft EIS analyzes the drilling of 400 new wells within the EIS assessment area. It also incorporates the changes which have occurred since the Marquiss (40 wells) and Lighthouse (200 wells) EAs were completed. These changes deal mainly with the increased rate of development and the increased pumping rates which have occurred because of changes in technology. We regret any confusion this may have caused.
2. Please see chapter 1 of the final EIS for a clarification of purpose and need.

Please see chapter 2 of the final EIS for a discussion of how the alternatives were handled. Because we have the authority to restrict the timing on approval or reduce the number of wells drilled, which would be a lessening of the impacts expected if the number of number of fee/state wells did not increase correspondingly, we believed additional analysis for the sake of analysis would not add to the document. We were attempting to present a concise document which the public would read.

3. All maps are approximately one eighth inch to the mile. A map showing the major drainages in the assessment area (map 6) has been included in this

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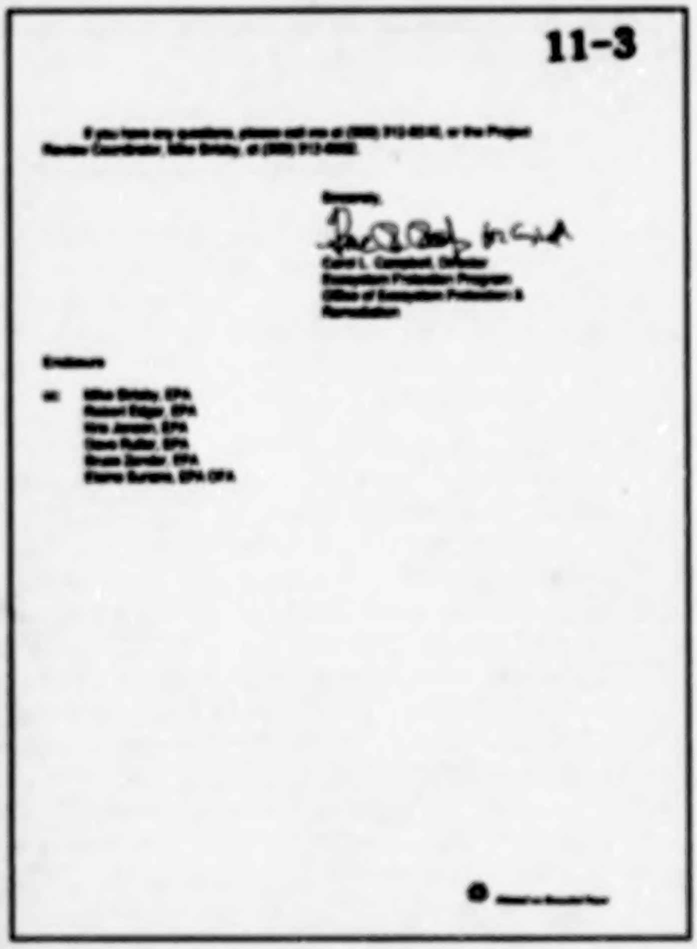

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Comment Responses

final EIS. Since the coal bed methane development is speculative in nature, it would be meaningless to include a map of well and transportation facilities. This is explained in chapter 2 of the final EIS. Maps depicting alternatives would also be purely speculative in nature. No critical wildlife habitat exists in the assessment area. The use of township and range references are a commonly used terminology which are familiar to most people.

4. So noted. The intent of the paragraph was to let the reader know that a large amount of documentation has already been done in and immediately adjacent to the assessment area.

5. Please see the response to comment number two of this letter.

6. This EIS is tiered to the Buffalo RMP (USDI, BLM 1985) which analyzed the impacts of leasing oil and gas. One of the decisions of the RMP was to continue leasing of oil and gas in the resource area subject to standard and identified site-specific appropriate mitigation measures.

7. Plugging wells and reclaiming drilling locations are part of the normal permit approval process. Plugging operations call for the coal zone to be completely cemented off and then the open hole above the coal is filled with bentonite. This is in line with the requirements of the WOGCC. Reclamation is handled on a case-by-case basis depending on the location. This is addressed as part of the APD approval and EA which is completed on each well location. Normal reclamation calls for complete rehabilitation of the site and access routes for roads and pipelines.

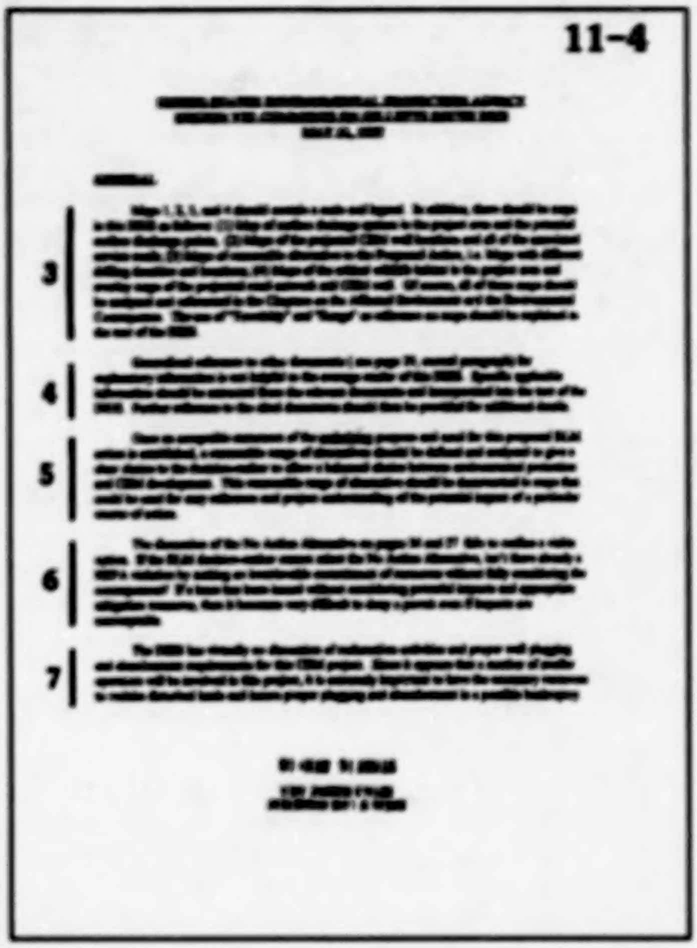
   The EPA is assuming that since a number of smaller operators are involved in this type of development that work completed will be less than satisfactory or that the operators may default. The BLM cannot make this type of assumption. If operators post adequate bonds as defined by our regulations, we must treat all operators equally. If an operator fails to perform as required, BLM at that time may chose to increase bonding requirements. This has not occurred to date in development of coal bed methane.

8. So noted. Please see the "Errata" section for chapter 3 for the correction.

9. So noted.

10. No BTEX or VOCs exist. The gas produced is methane, nitrogen, and carbon dioxide. The gas makeup varies slightly but averages 95% methane, 3% nitrogen, and 2% carbon dioxide. A gas analysis is included in chapter 4 to show an actual sample.

11 Since there are no VOCs associated with the methane, no VOCs are emitted from the compressors. With no VOCs and no C3+ molecules, the possibility of formaldehyde being produced by either the compressors or the gas dehydration units is extremely



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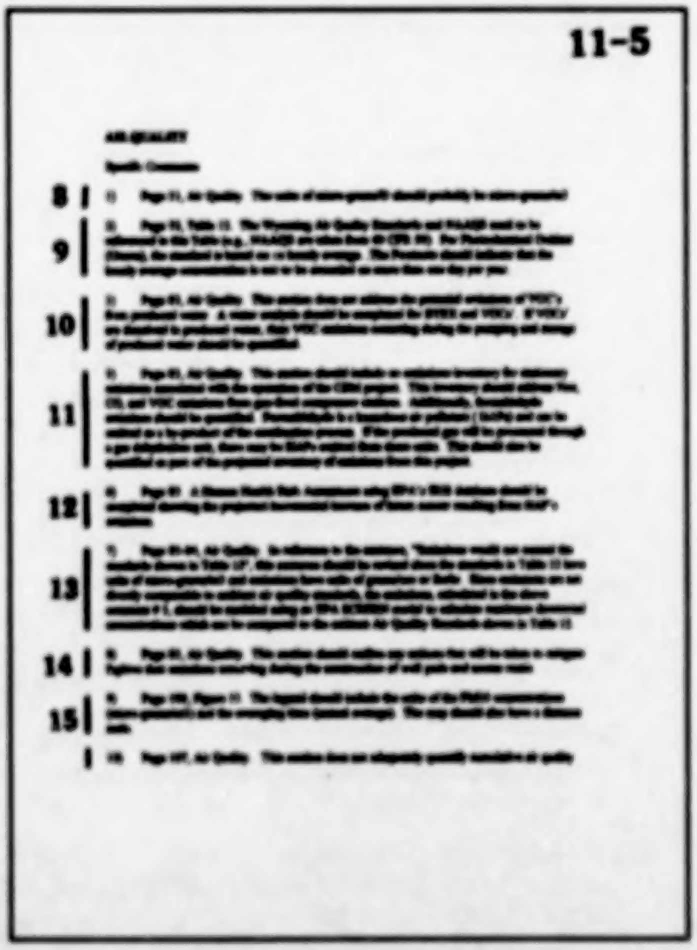

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Comment Responses

remote. Please see chapter 4 for an inventory of emissions from the compressor engines.

12. No hazardous air pollutants (HAPs) have been identified. Please see the response to comment number 11.

13. Please see additional air quality information presented in chapter 4 of the final EIS.

14. During the APD approval process, standard stipulations such as watering of roads, are applied as needed to control fugitive dust emissions. CBM development with minimal road and pad construction as described in the proposed action, chapter 2 of this document, reduces the incidence of fugitive dust emissions by minimizing the amount of surface disturbance that occurs.

15. So noted. The figure scale is approximately _ inch to the mile.

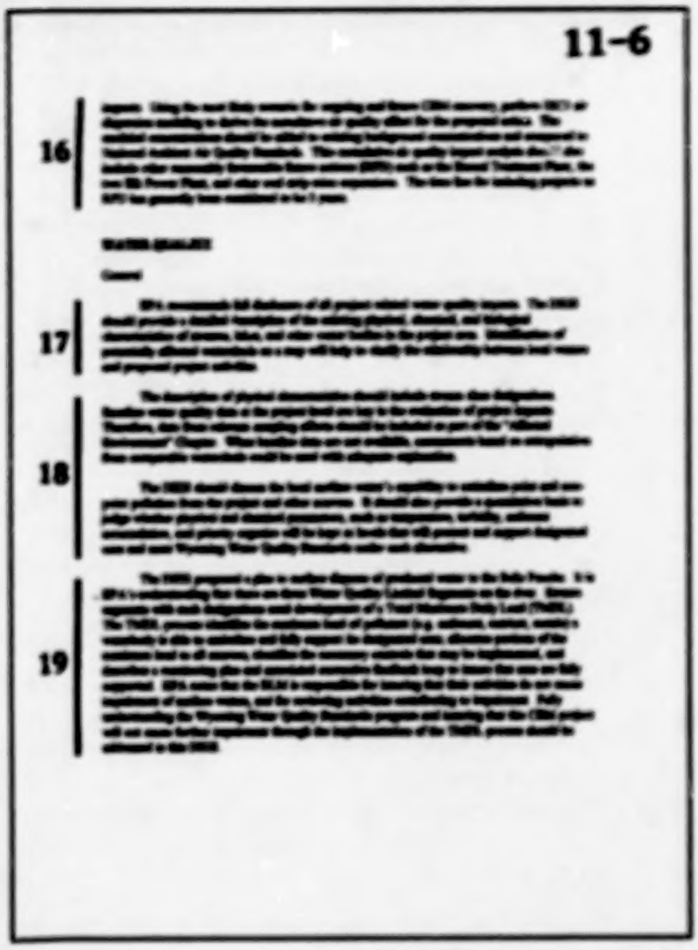
16. Please see chapter 4 of the final EIS for a discussion of cumulative air quality impacts.

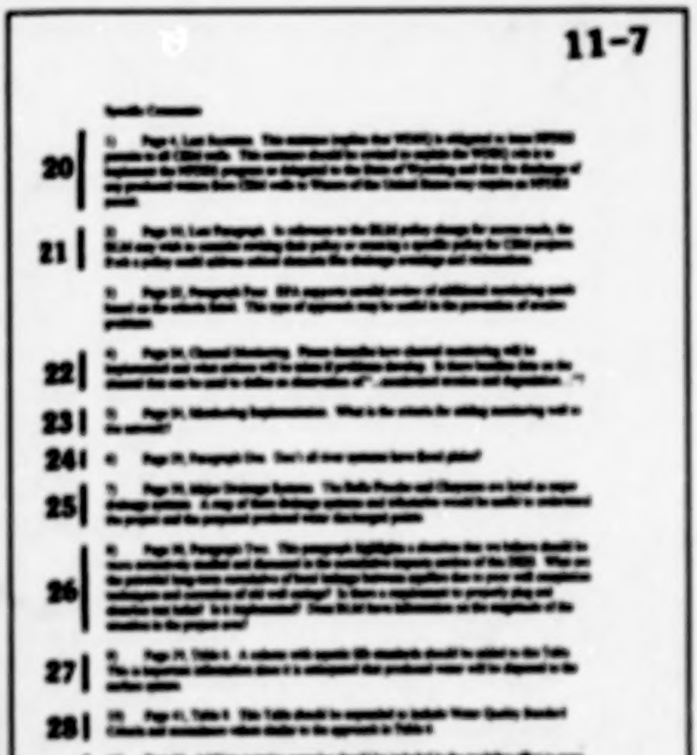
17. The draft EIS (pages 38 through 44) provides information on the physical, chemical, and biological characteristics of the streams in the assessment area. A map has been added in the final EIS to show stream locations (map 6). The only water bodies which exist are stockwater reservoirs. As we do not know specific locations of discharge points until development occurs, potentially affected watersheds include any of those within the assessment area.

18. All existing discharge points have been into Class IV waters. There are few waters within the project area that are classified other than Class IV. As each discharge point must have an NPDES permit, the potential impact to surface waters will be evaluated and mitigated at the time of discharge point siting and permitting. The draft EIS, pages 35 through 38, and tables 6 and 8, discuss surface and subsurface water quality. Impacts of discharge to surface waters is discussed on pages 77 and 78 of the draft EIS.

19. As of May 25, 1997, the EPA has not released draft total maximum daily load (TMDL) guidance for us to follow. The WDEQ, in conjunction with the BLM, Wyoming State Office, has just recently completed initial contacts with the field offices concerning TMDLs. We have not completed our review of the initial draft list of Water Quality Limited Segments (WQLS) compiled by the WDEQ. Based on this review, the list will probably be revised as there was some confusion on what constituted a WQLS when nominations were made by various entities. Considering these facts, it is premature for us to be addressing TMDLs in this document. When the TMDL process is finalized, the BLM will incorporate this into our permitting process and comply with these guidelines.

20. This section of the document is a description of what actions must occur before an operator can proceed.





Comment Responses

The sentence is not intended to imply that WDEQ is required to issue an NPDES permit, but rather they are the responsible agency for evaluating the permit and either granting or denying the application.

21. BLM in Buffalo has been following this policy since 1992. As part of the APD approval process, potential problem areas are handled on a case-by-case basis.

22. Our proposed methodology to monitor channels includes establishing cross sections that can be repeatedly checked and monitored over time. This will include photos as well as physical measurements. In the instance where additional mitigation is needed, the BLM will work with the operator in relocating and/or revising operating practices (outlet works, discharge timing/volumes, etc.) so that channel stability is maintained.

23. We intend to establish a monitoring network sufficient for monitoring the predicted impacts of the development and for establishing the extent and degree of the impacts. If development is proposed in areas where the existing monitor wells are not sufficient to meet these two primary goals, we will add additional wells. This will be accomplished by incorporating existing wells where possible or requiring the operator to drill additional monitor wells.

24. You are correct in your statement that all river systems have flood plains, but they are not adversely affected by this action. In this case, we are referring to flood plains as delineated by the U.S. Geological Service for the Federal Emergency Management Service (FEMA).

25. Please see our response to comment number 17 of this letter.

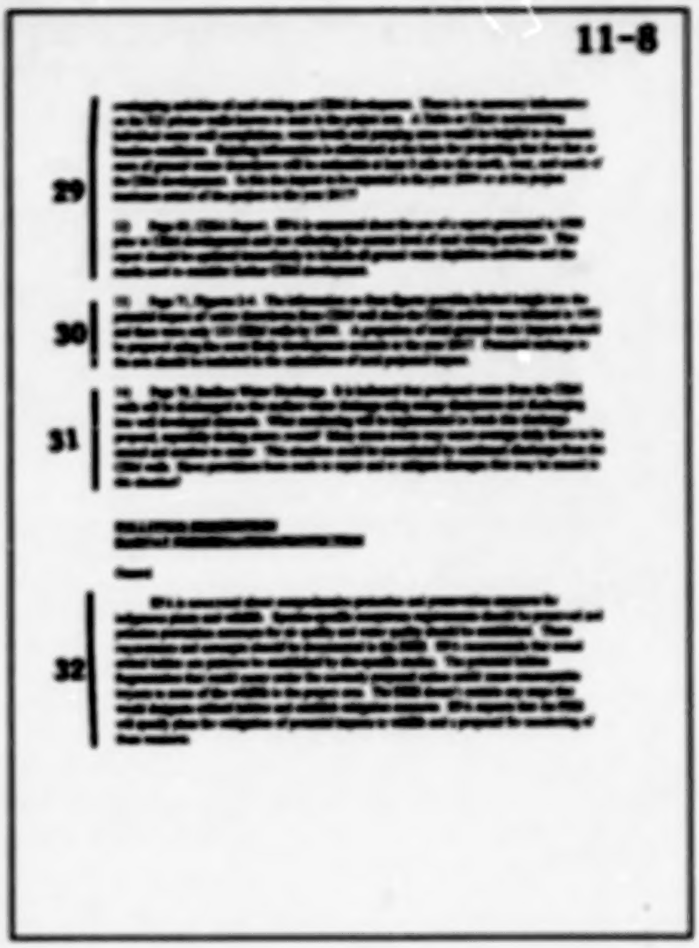
26. As stated in the last sentence of the paragraph, the potential leakage between aquifers due to poor well completion has not been documented as a problem. It is discussed here as a potential pathway for leakage that would have to be considered if identified.

There is a requirement to properly plug and abandon test holes as well as abandoned wells, and it is currently enforced by the WOGCC and the BLM. However, requirements and levels of enforcement have become more stringent over time as downhole concerns were identified.

27. The table compares the produced water to drinking water standards. Drinking water standards are normally higher than aquatic life standards.

28. Please see chapter 3, "Errata" section, for a revised table 8 showing these standards.

29. This modeling effort was done as part of the Lighthouse EA and is included here only as additional information. No numerical modeling was done as part of the Gillette South analysis due to the proximity of the Lighthouse area and the logical extension of that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Comment Responses

analysis. However, as part of the ongoing CHIA effort, a larger area, including a portion of the assessment area within this analysis, is currently being modeled. Also, please see response number one to Kennecott Energy Company's comment letter.

As discussed on page 32 of the draft EIS, a complete list (with completion information, yield, etc.) of all 6,100 wells, including the 323 private wells completed in the coal, is available at the BLM offices in Casper and Buffalo, and the information from all the wells in the state is available from the WSEO. This list is too lengthy to include in its entirety in the document.

Once again there is confusion here on the dates for the life of the project. The 2004 date came from the modeling effort in the Lighthouse project. The maximum probable drawdown for this project is projected for the life of this project through 2017.

30. As discussed in the analysis, the projected total groundwater impacts through the life of the project (2017) results in a lowering of the potentiometric surface of the coal aquifer less than five feet, at distances greater than 8 miles west, east, and south of the project area. Also, please see the response to comment number one of Kennecott Energy Company's letter.

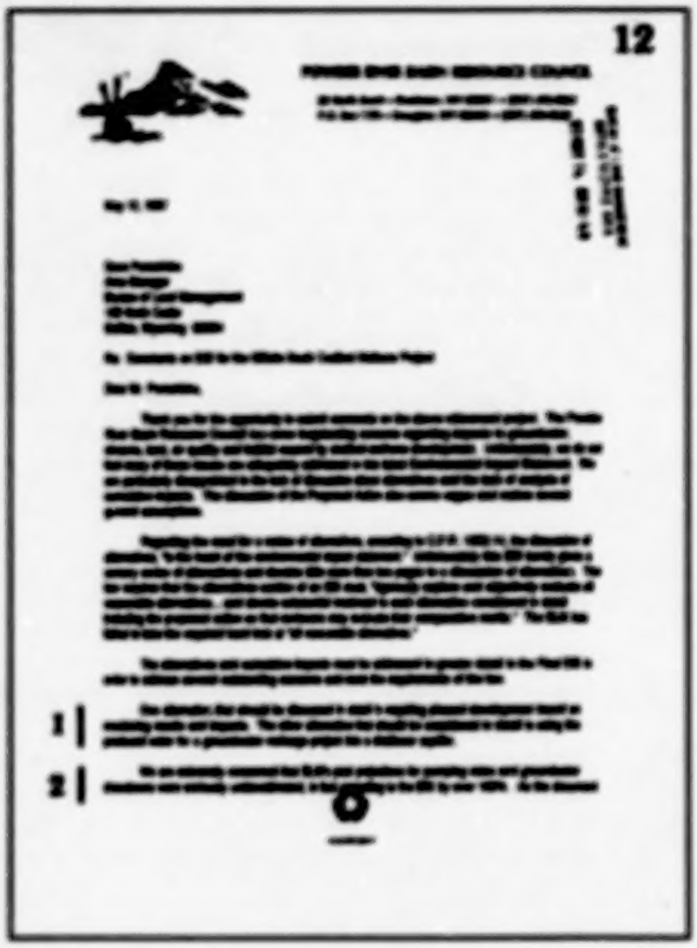
The potential recharge is unknown at this time. It is speculated that recharge is occurring from the outcrop areas and by a limited extent from interaquifer communication. However, quantification of these sources has not been done.

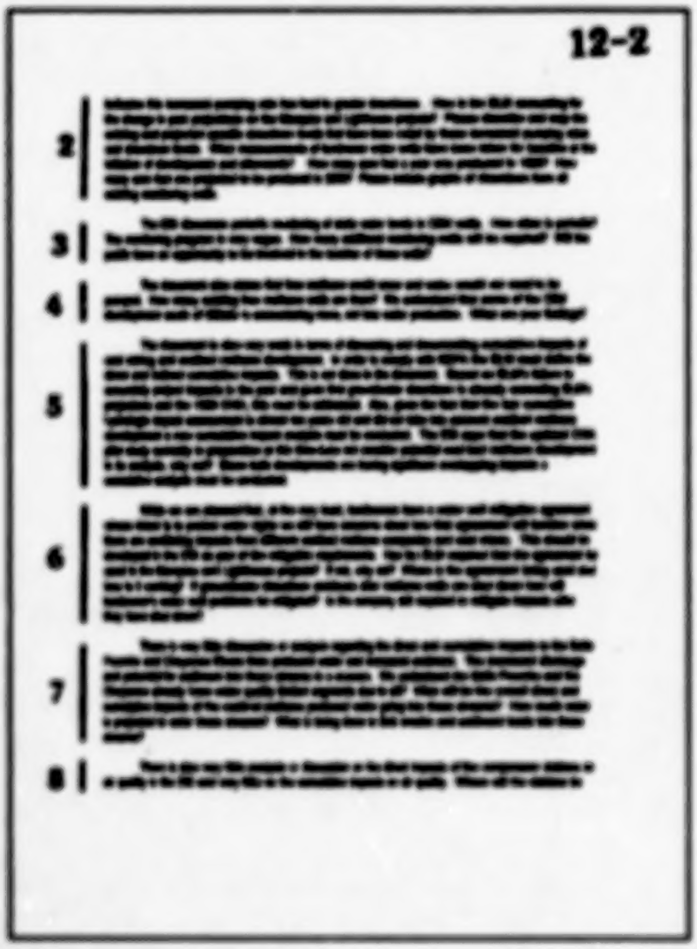
31. Monitoring similar to that described in comment response number 21 (permanent cross sections, photo points, etc.) of this letter will be implemented below the discharge points.

As discussed in the "Surface Water" portion of the draft EIS in chapter 4, the discharge (0.22 cfs) from any given point will be less than or equal to the two-year, 24-hour storm. As can be seen from table 9, this maximum discharge (0.22 cfs) is less than 0.1% of the average ten-year discharge per square mile and less than 0.025% of the average 100-year discharge per square mile. This increase in discharge during storm events will be insignificant.

Discussions with the operators have occurred concerning the location and design of discharge points. The operator that we have dealt with the most to date (American Oil and Gas) has been extremely conscientious about discharges and has made any modifications that we have required to their discharge points.

32. No critical habitat exists in the assessment area. If any had existed, it would have been identified in the RMP and appropriate stipulations would have been attached at the time of leasing. If any is identified in the future, proper mitigation stipulations will be applied at the time of APD approval.





Comment Responses

Response to Letter 12, Powder River Basin Resource Council

Thank you for your interest in the coal bed methane EIS process.

1. Both of these alternatives were discussed. BLM has the authority to restrict timing of approval of federal wells, and we are monitoring to determine if impacts are as predicted. Since this would slow down impacts but not change them, the proposed action presents an accurate analysis of what will occur.

   As discussed in chapter 2 of the final EIS, injection under current law would be required to an aquifer of lesser quality than is being produced. Recharge of shallower aquifers is being accomplished in a defacto manner. Water being discharged on the surface is percolating into the shallow water tables which recharges these zones.

2. The document indicates an increase in the rate at which the drawdown occurred in the Marquiss project. This was a function of the pumping rate and the rate at which development occurred; it is not an increase in the total impact which was predicted.

   The increased pumping rates have been taken into account in the South Gillette analysis. A description of the projected drawdowns is discussed on page 93 of the draft EIS in the "Cumulative Impacts" section. Here it states that drawdowns could occur in the coal aquifer over as much as 600 square miles. These drawdowns include those that are greater than or equal to five feet. These impacts will occur from the coal outcrop in the east for a distance of approximately 8 miles, north, south and west of the CBM development.

   The proposed monitoring plan in chapter 2 of this document identifies baseline and continued monitoring to be done by the operators on private wells.

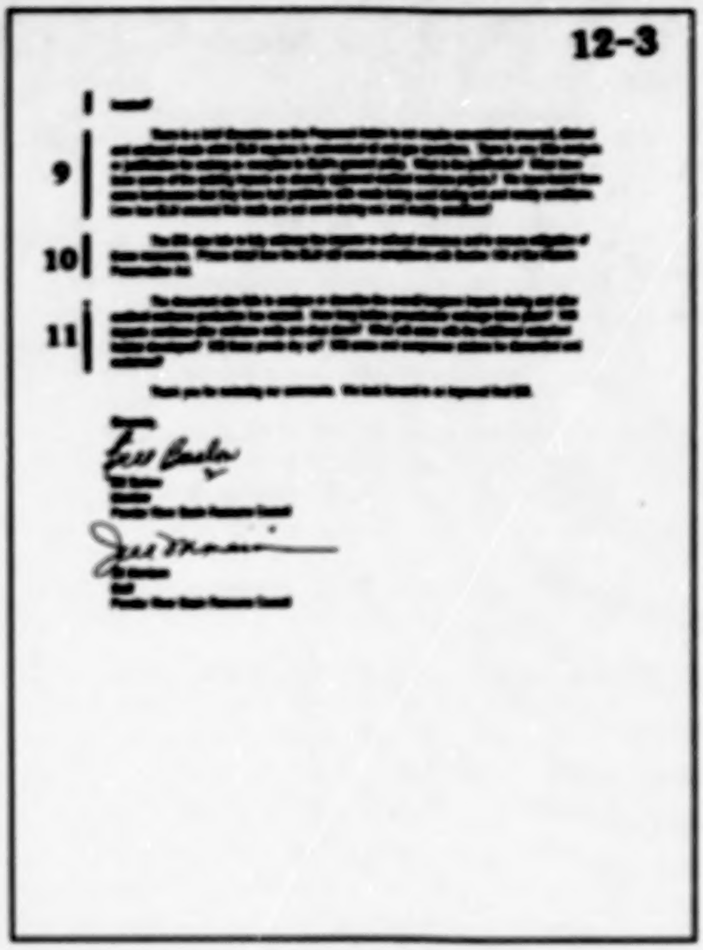
   There were approximately 2,500 (2494.8) acre-feet of water produced in 1996.

   The estimated production from 640 wells in 2000 is 8,960 acre-feet.

   A cumulative drawdown map from all the monitoring wells is included in the draft EIS (figure 12). Individual graphs of BLM monitor wells can be found in the appendix of this final EIS. Individual well data from the coal mines is published in the GAGMO reports.

3. The periodic monitoring is described in chapter 2 of the final EIS. Operators have to report monthly to the WSEO.

   The number of additional monitoring wells that will be required is a function of the actual development. A list of the existing and proposed monitoring well locations is presented in tables 1, 2, and 3 of the final EIS.



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Comment Responses

If a private landowner is interested in having a dedicated monitoring well set on his or her property, and is willing to grant access, we would certainly consider this location in lieu of one of the proposed locations.

4. Information we have as of February 1997 shows approximately 30 wells producing free methane in the assessment area. More than this may occur, but there is approximately a two and one-half month lag in production reporting. If the commentor is referring to the Durham Ranch activities, it is too early to tell if increased water production is or will continue to occur.

5. Please see the response to comment number two of Robin Reints' letter. A groundwater drawdown model is being tested on the southern pod of mines in the basin. The model was developed to predict the extent of the five-foot drawdown in the Wyodak coal as a result of anticipated coal bed methane development and coal mining in the Powder River Basin. Also, please see response to comment numbers one and two, Kennecott Energy, on why additional modeling was not done. We did analyze impacts to groundwater using our monitoring information, the Lighthouse model, and 15-year GAGMO data. This discussion can be found on pages 71 through 77 of the draft EIS.

6. Wyoming state water law and regulations require offending parties to mitigate well owners if they are impacted. Monitoring carried out by the coal mines, CBM operators, and the BLM will provide information to help sort out the question of who is responsible.

   Some if not all operators are offering the well agreement to surface owners as development occurs. BLM is not requiring operators to offer the agreement at this time as it is being analyzed as part of the proposed action. Until a record of decision is signed, we cannot require it. We are however, urging operators to offer the water well agreement to all affected landowners as development occurs. Our ability to require the use of the water well agreement once the record of decision is signed will only pertain to federal minerals. Our knowledge so far about how the agreement is working is limited since it is a third party agreement that BLM is not privy to. So far, we have not heard any complaints. We have had phone calls from adjacent landowners requesting to be included in a water well agreement, and we have referred them to the appropriate CBM operators. It is currently unknown how long the lowered water levels will persist. This is a function of the recharge to the aquifers which has been but loosely defined and not at all quantified. It is certainly a reasonable request that the water well agreement be interpreted for the life of the impact.

7. Please see the responses to comments 19 and 31 of the Environmental Protection Agency's letter. The impacts to the major receiving streams (Belle Fourche and Cheyenne rivers) is expected to be minimal. The

total discharge from all proposed 640 CBM wells is 28 cubic feet per second. Of this, only a fraction will actually reach the main stem of these streams. Through 1995 with approximately 10% of the CBM wells on line, no discernable change in discharge has been measured in the Belle Fourche River at a gauging station downstream from the existing CBM developments.

Sediment in these streams is primarily moved during storm events. Peak flows by recurrence interval from selected streams is listed in table 9 of the draft EIS. The measured peak discharge at the gauging station on the Belle Fourche River is listed in table 8 in the "Errata" section in chapter 3 of this final EIS. As can be seen from this data, the portion of the worst case 28 cfs which reaches the main stem of these streams is relatively insignificant with respect to peak flows. With proper surface mitigation of well sites, access roads, and ancillary facilities, the increase in erosion and available sediment would be minimal.

8. Please see the responses to comment number 13 and 16 of the Environmental Protection Agency's comment letter. New compressor stations will be located where favorable coal structures are found that will produce methane.

9. The rationale for this policy which has been followed since 1992 is contained in chapter 2 of the final EIS. There have been some instances where roads were used when wet. We do not know if this occurred on fee or federal minerals. When we find problems on federal minerals we require the operator to fix the problem. The APD approval has language which addresses this issue, but we cannot be at all places at all times. We must rely on the operators to comply with the terms and conditions of the APD.

10. Cultural resources are handled as part of the normal permitting process. Consultation with the State Historic Preservation Office and appropriate mitigation are part of this process. NEPA assumes normal permitting processes are part of the Proposed Action and need not be discussed.

11. Please see response to comment six of this letter and the response to comment 30 of the Environmental Protection Agency's letter. Recharge has been occurring in coal mine spoil zones, but we cannot say what will happen down-dip from the outcrop.

Operators are signing agreements to turn over CBM wells to the landowners after methane production ceases if the landowner wants the well. If the wells are not pumped, the wetlands habitat will eventually dry up. On federal minerals, facilities no longer needed for CBM production will be required to be dismantled; disturbed areas will be reclaimed. We cannot say what will happen on private minerals, but from an economic standpoint, similar actions will probably occur.

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REFERENCES

Peacock, Kenneth.

1997 "Assessing the Cumulative Impacts of Surface Mining and Coal Bed Methane Development on Shallow Aquifers in the Powder River Basin, Wyoming." Paper presented at the 1997 National Meeting of the American Society of Surface Mining and Reclamation (ASSMR) in Austin, Texas, May 10-15.

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APPENDIX
EXISTING BLM MONITOR WELLS

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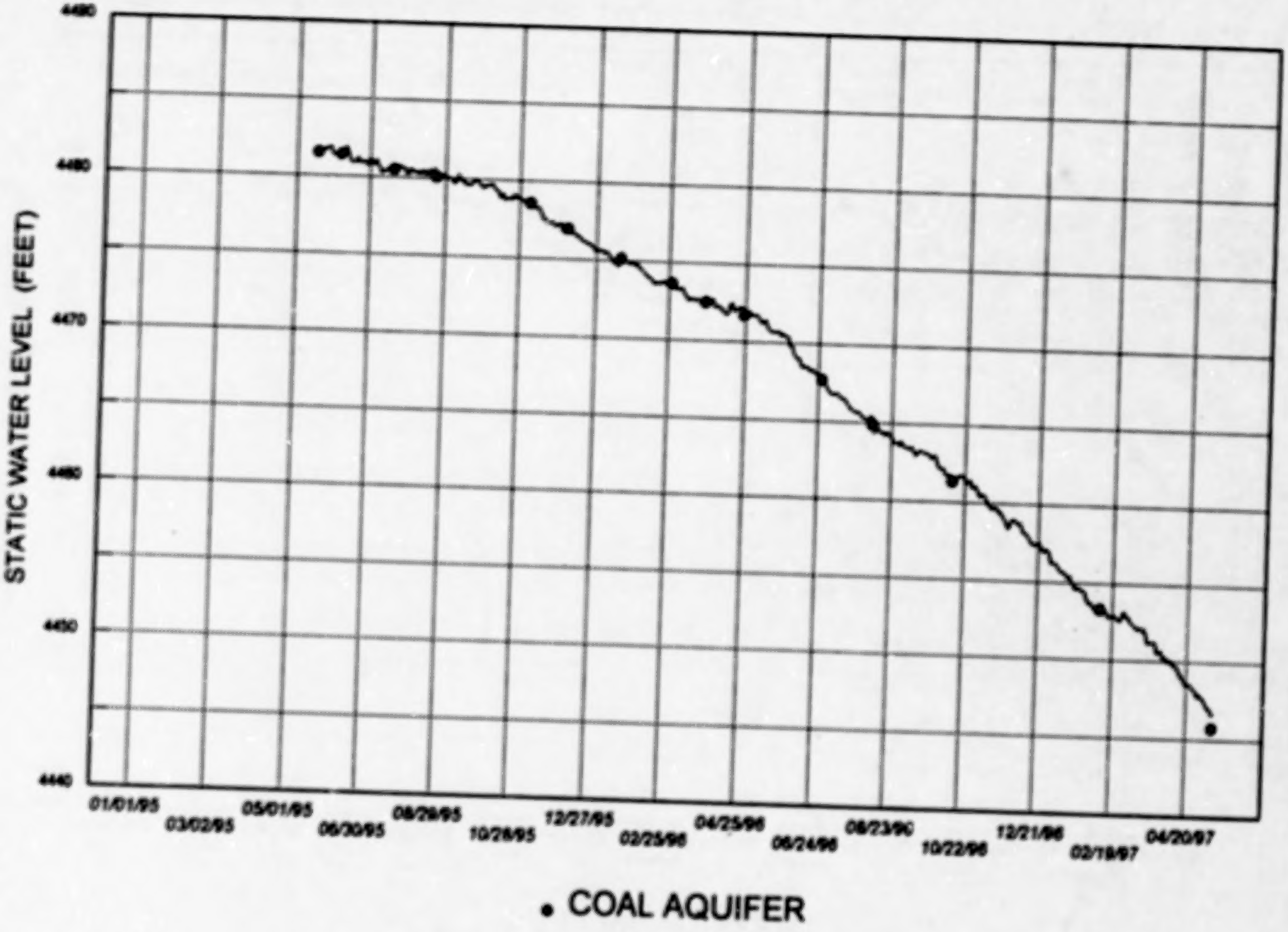
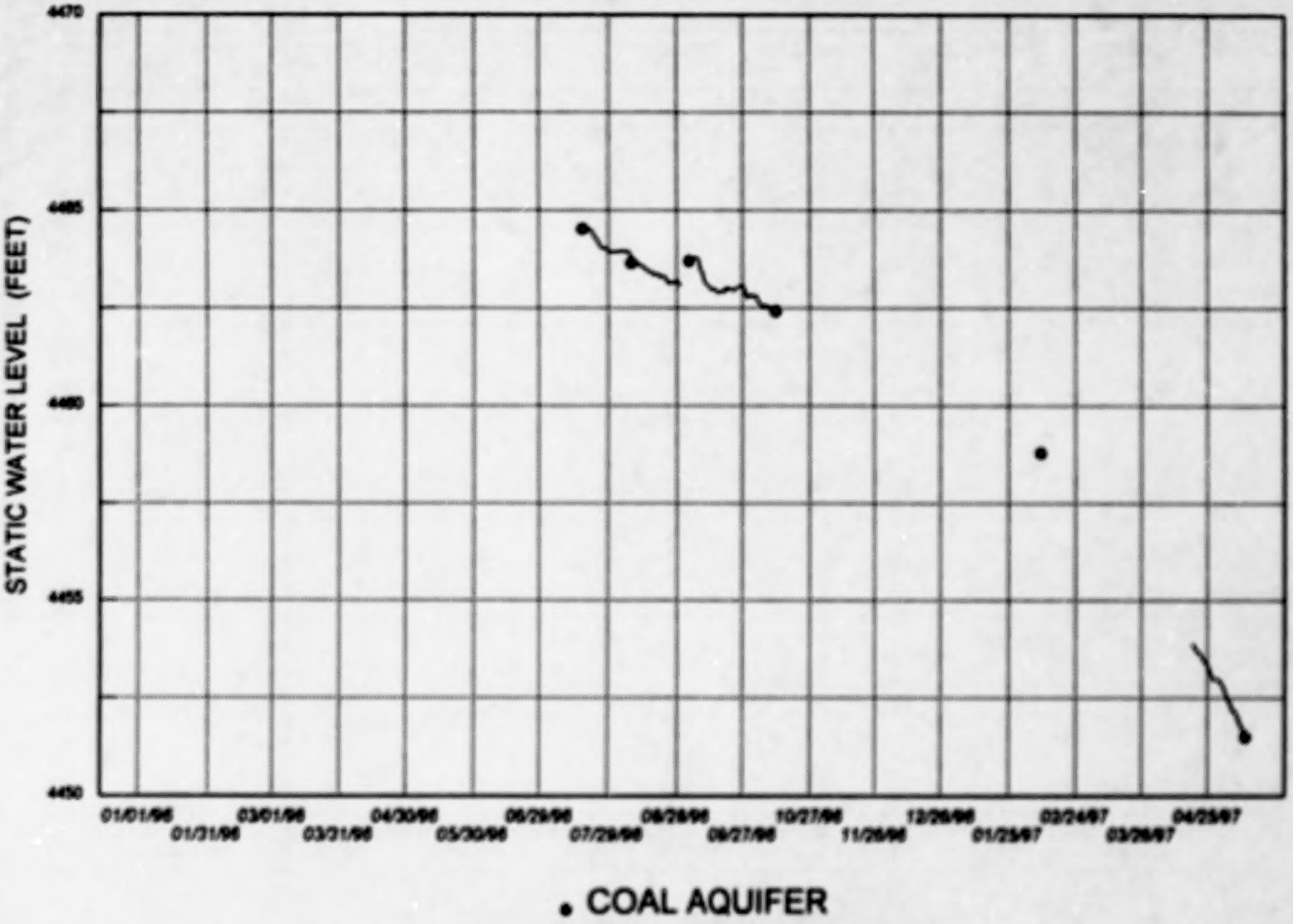
LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELLS
T46N R71W NE1/4 SW1/4 SEC. 6



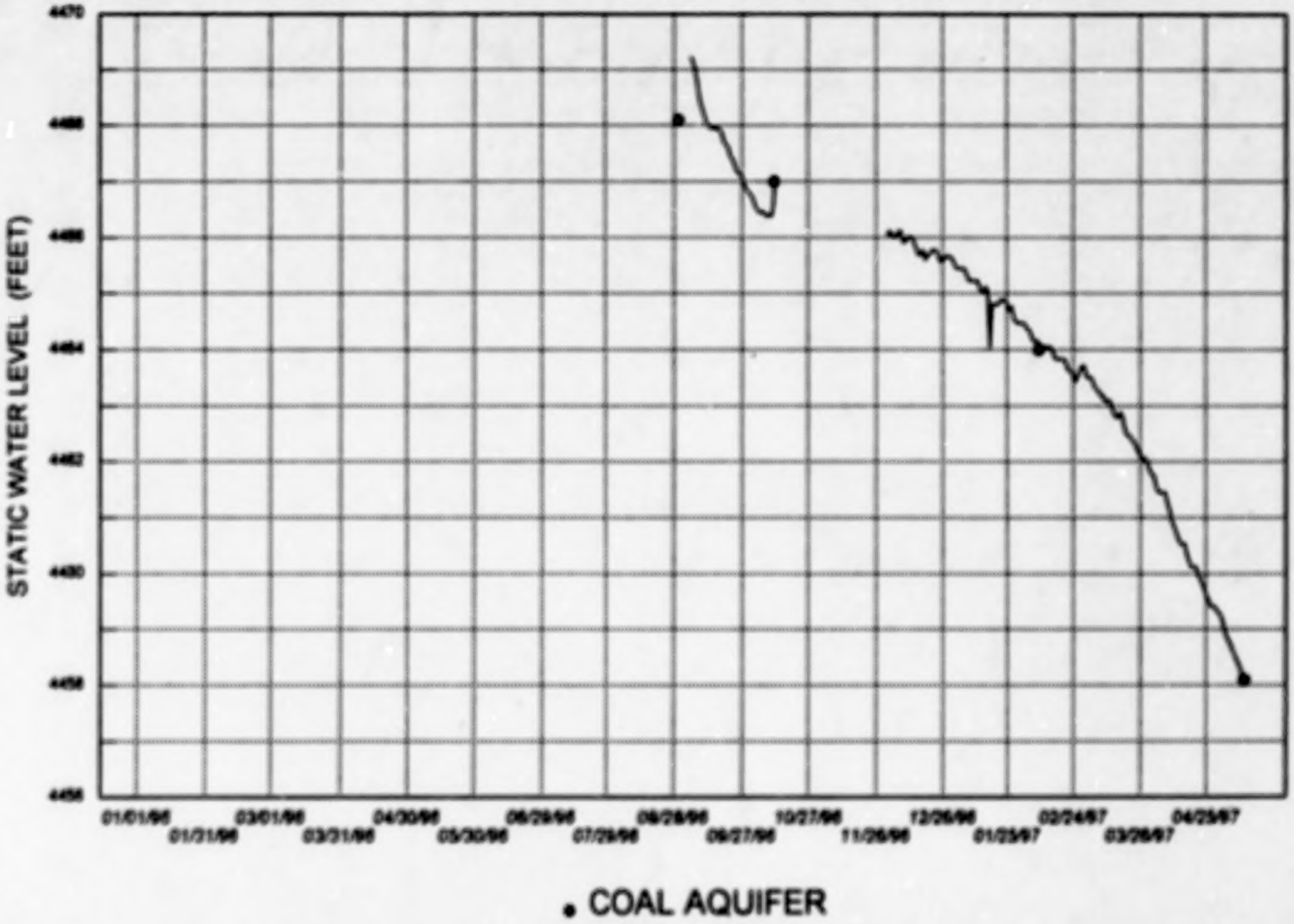
ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELLS
T46N R72W SW1/4 SE1/4 SEC. 16



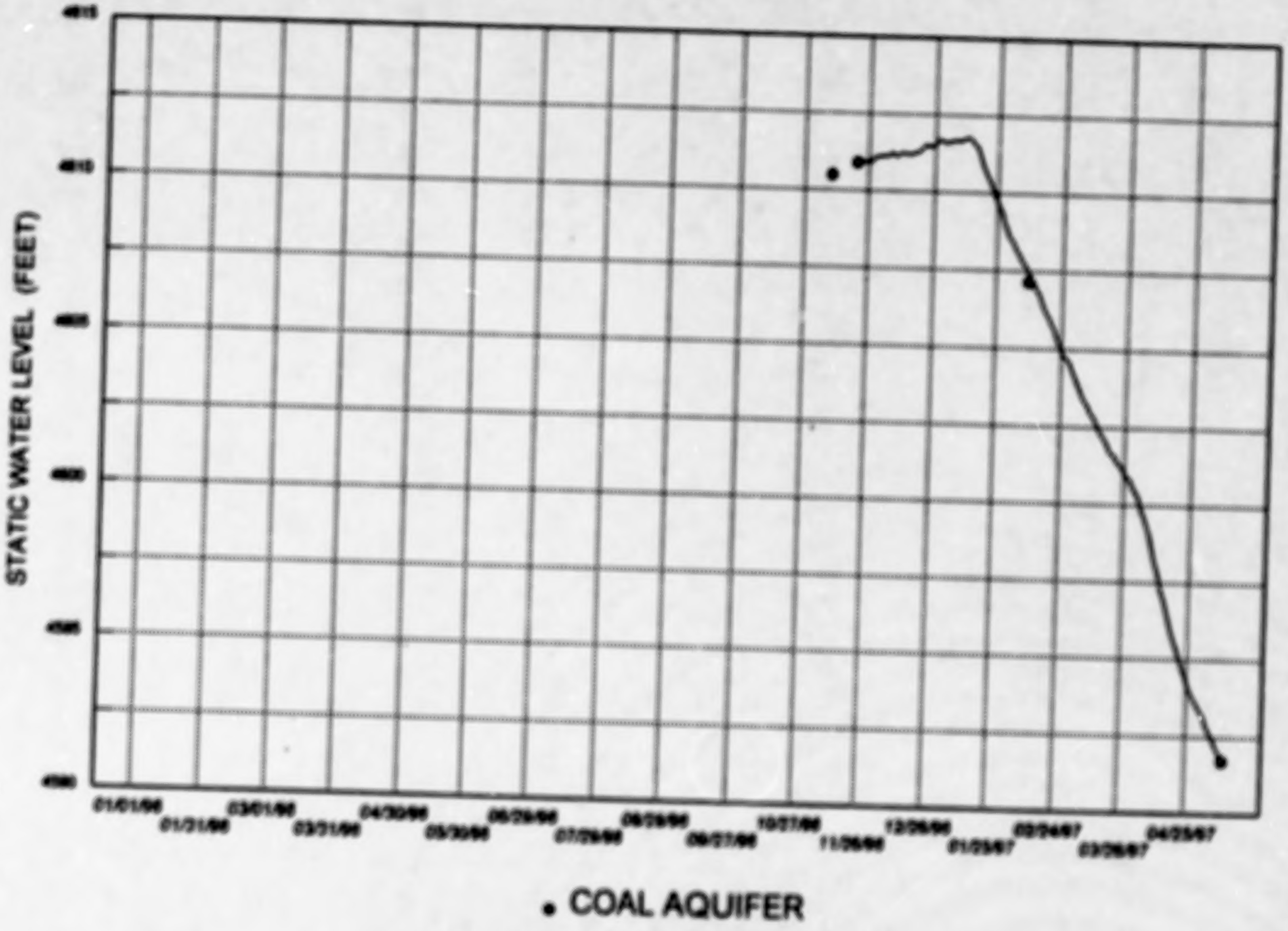
ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELL LIN W-2
T46N R72W SW1/4 SE1/4 SEC. 16



ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELLS
T46N R72W SW1/4 SW1/4 SEC. 25



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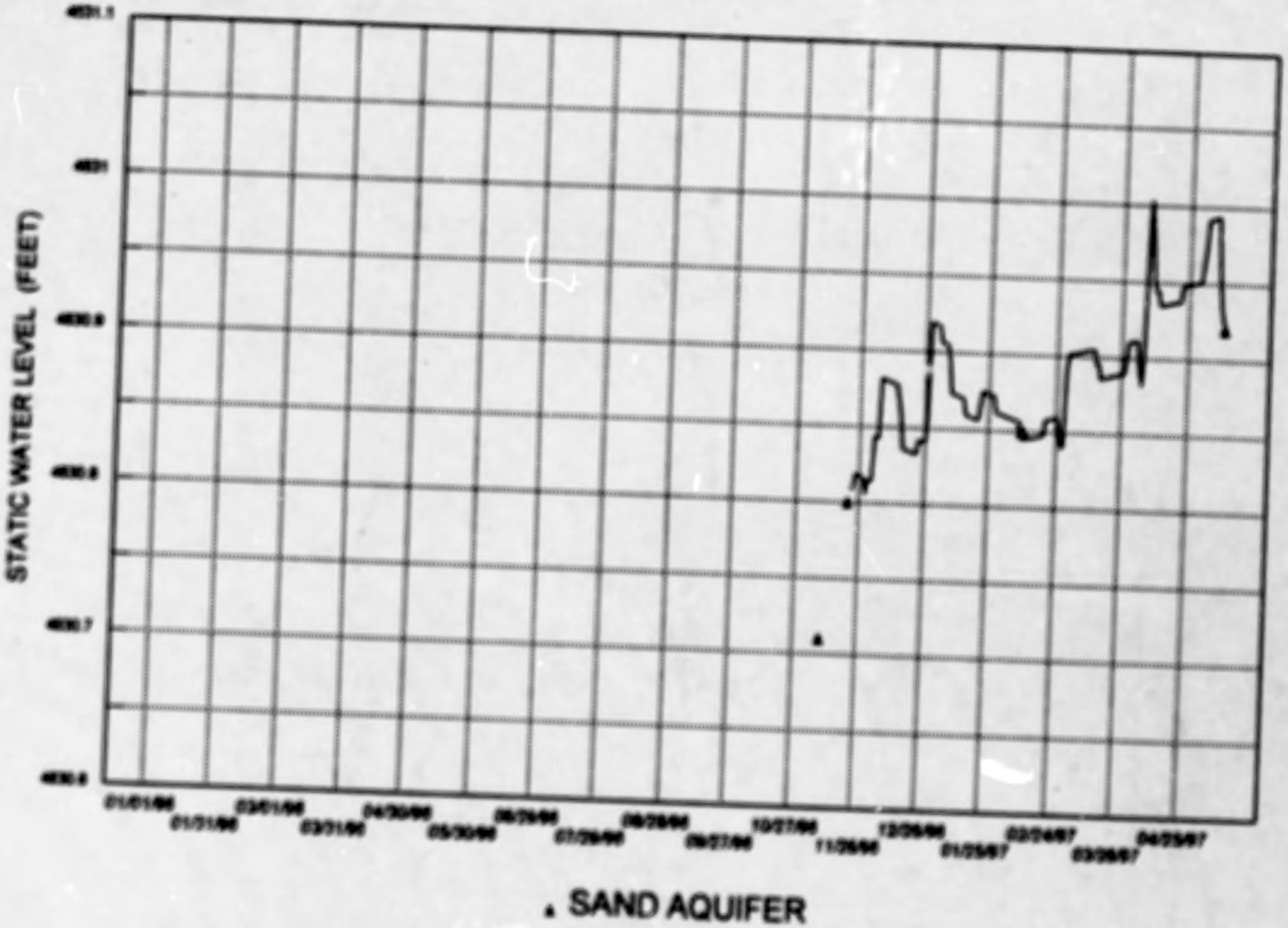
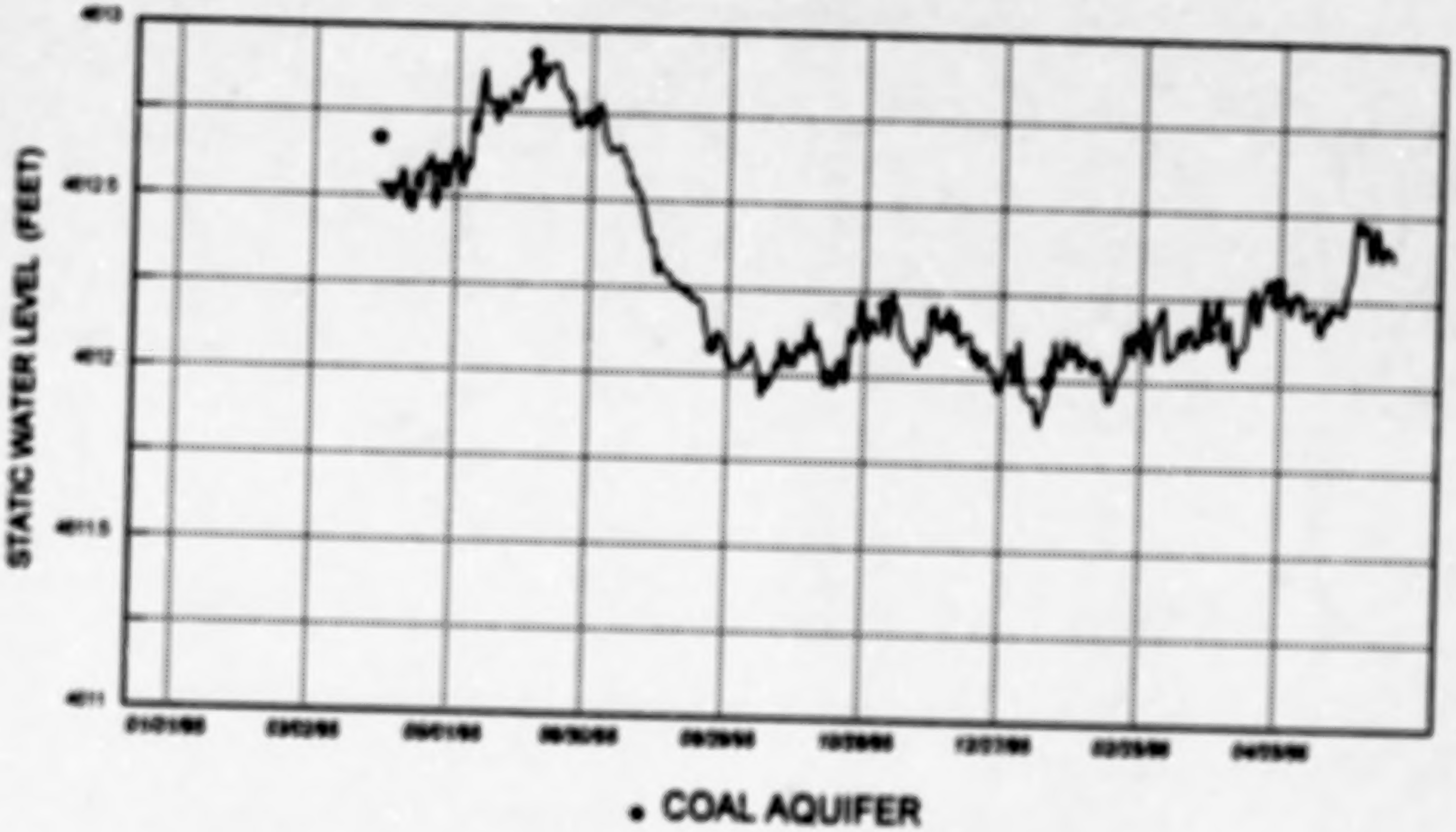
LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELLS
T46N R72W SW1/4 SW1/4 SEC. 25



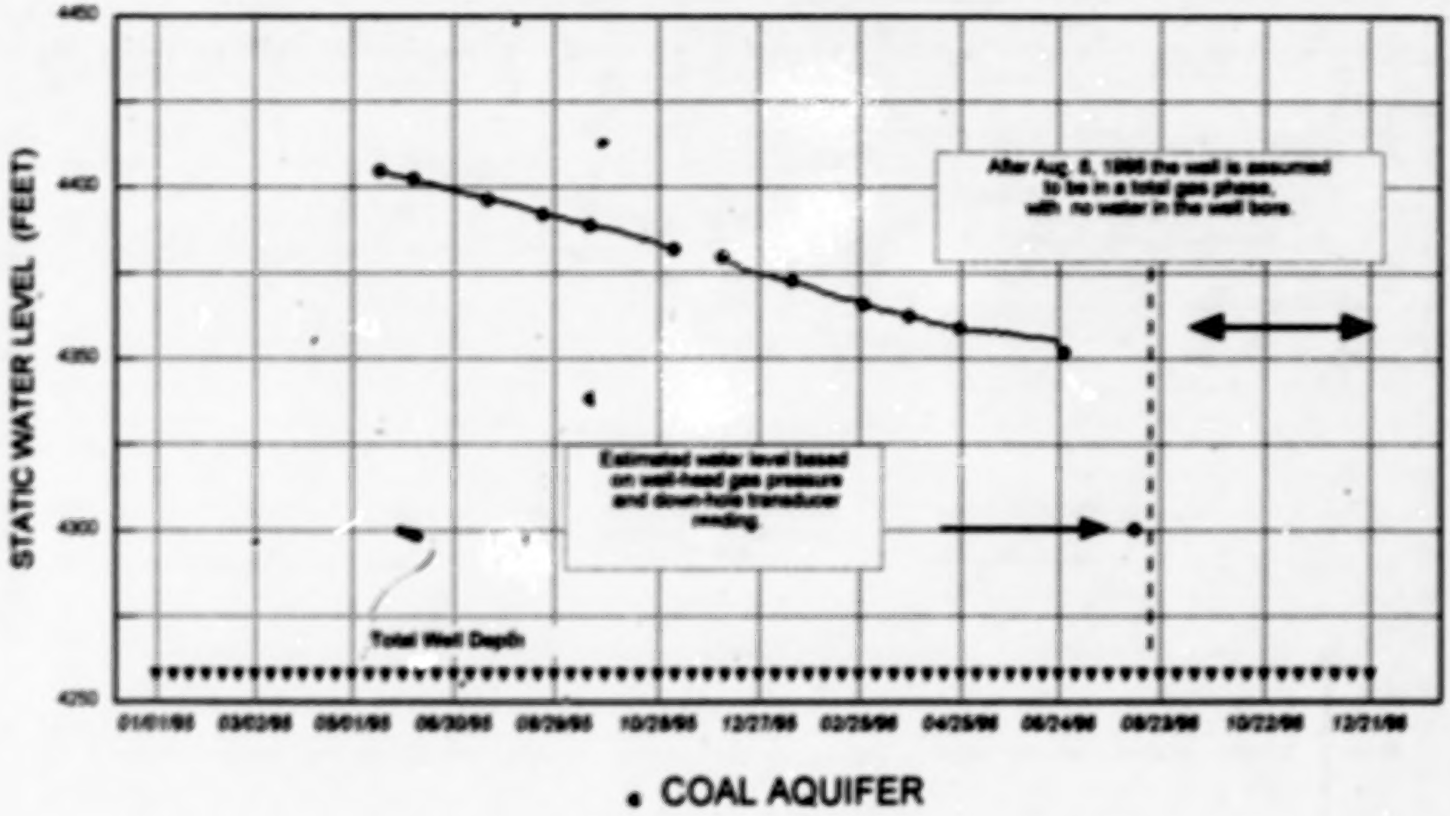
ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELLS
T46N R72W SW1/4 NW1/4 SEC. 36



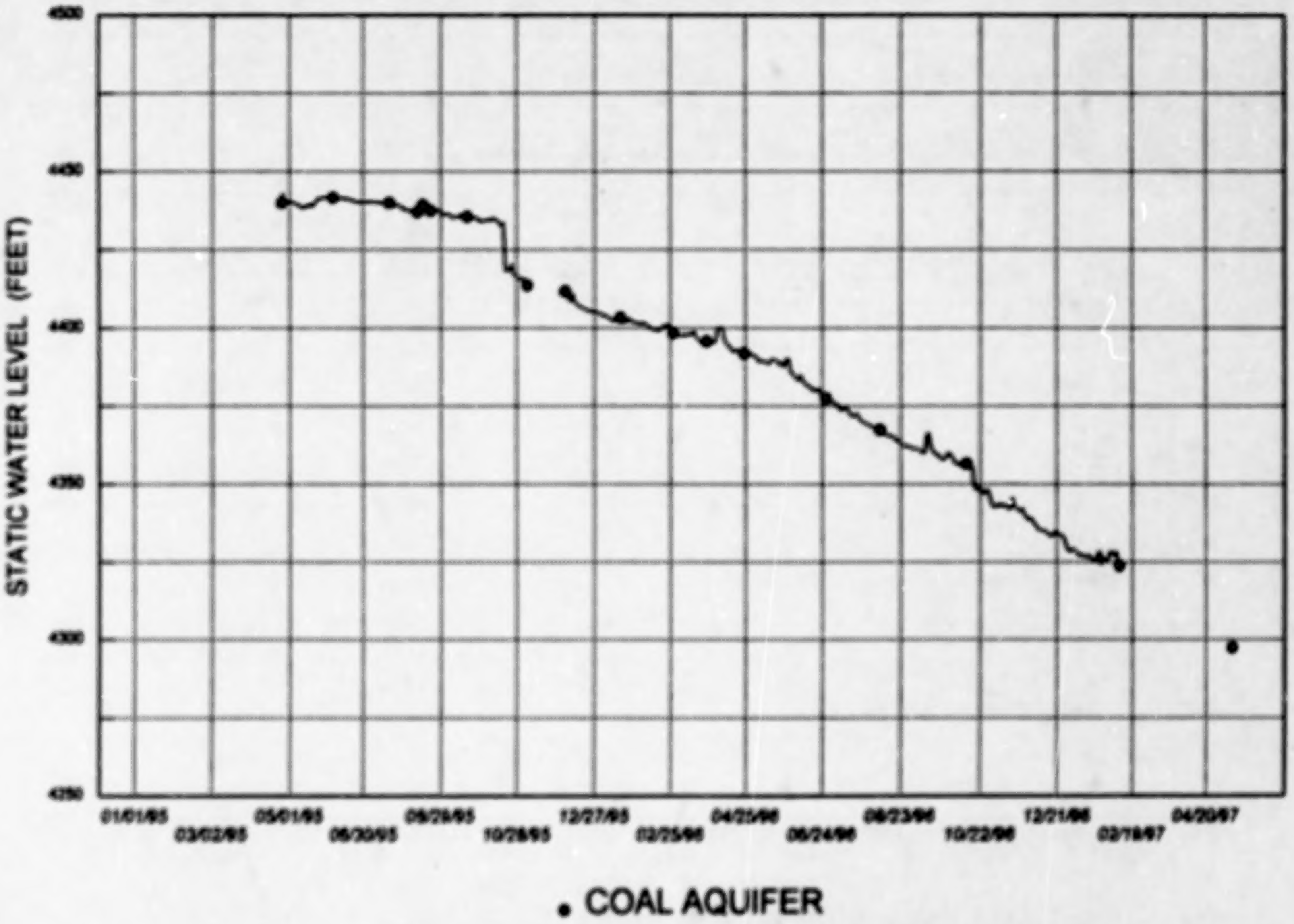
ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELLS
T47N R71W SW1/4 SW1/4 SEC. 19



ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

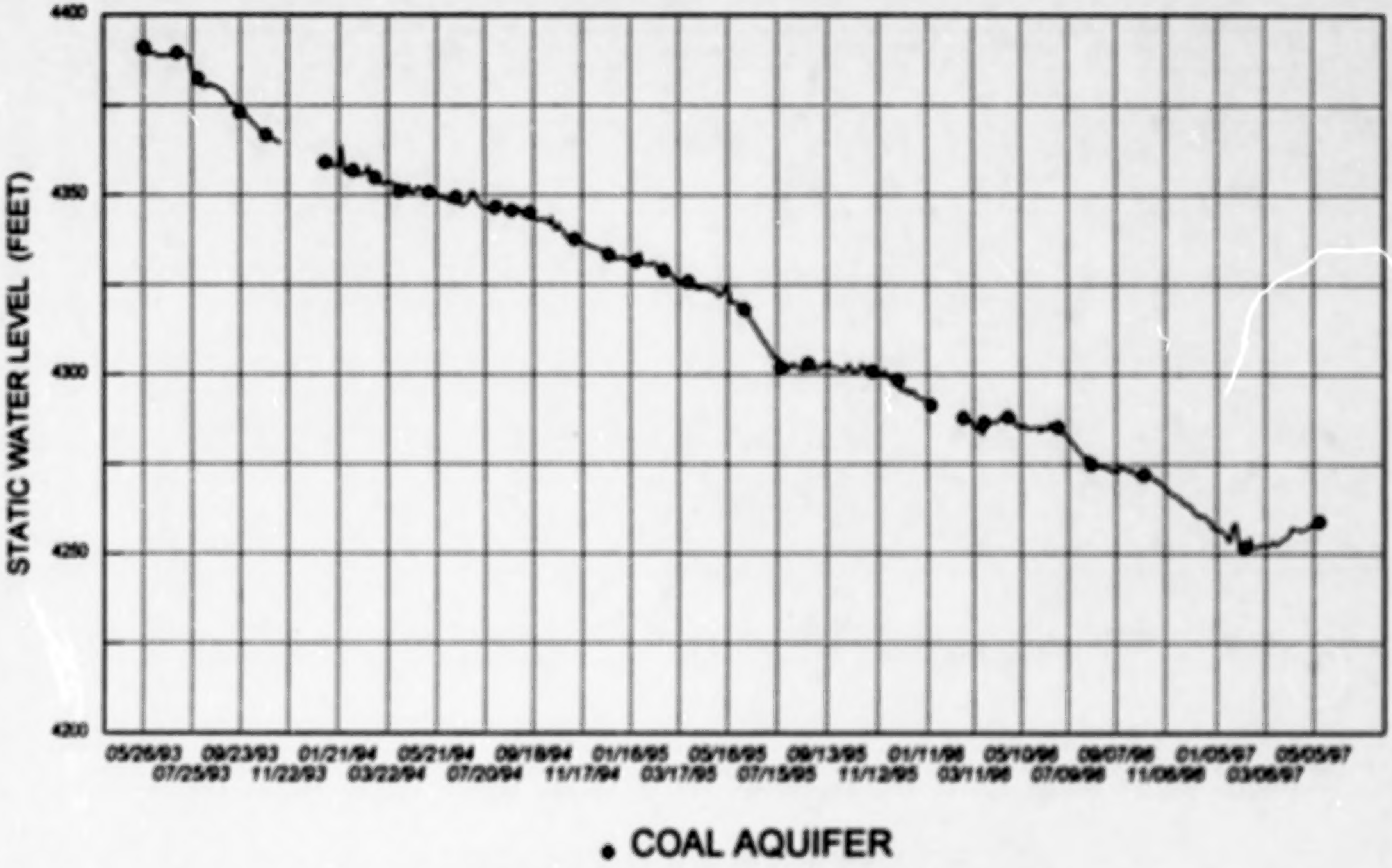
LIGHTHOUSE COAL BED METHANE - WATER MONITORING WELLS
T47N R72W SW1/4 NW1/4 SEC. 36



ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

MARQUISS PROJECT - WATER MONITORING WELL

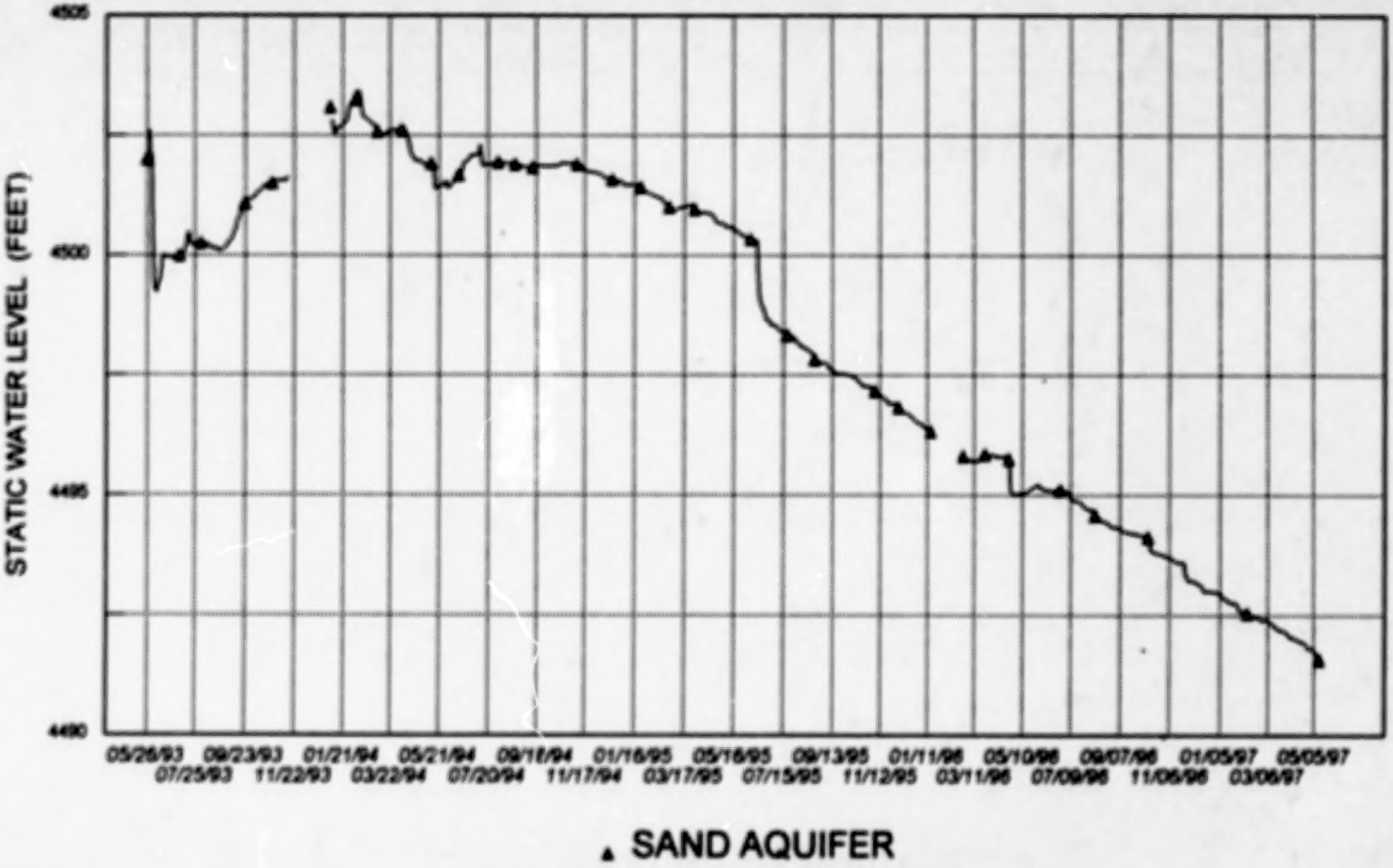
T47N R72W NW1/4 NW1/4 SEC. 2



ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

MARQUISS PROJECT - WATER MONITORING WELL

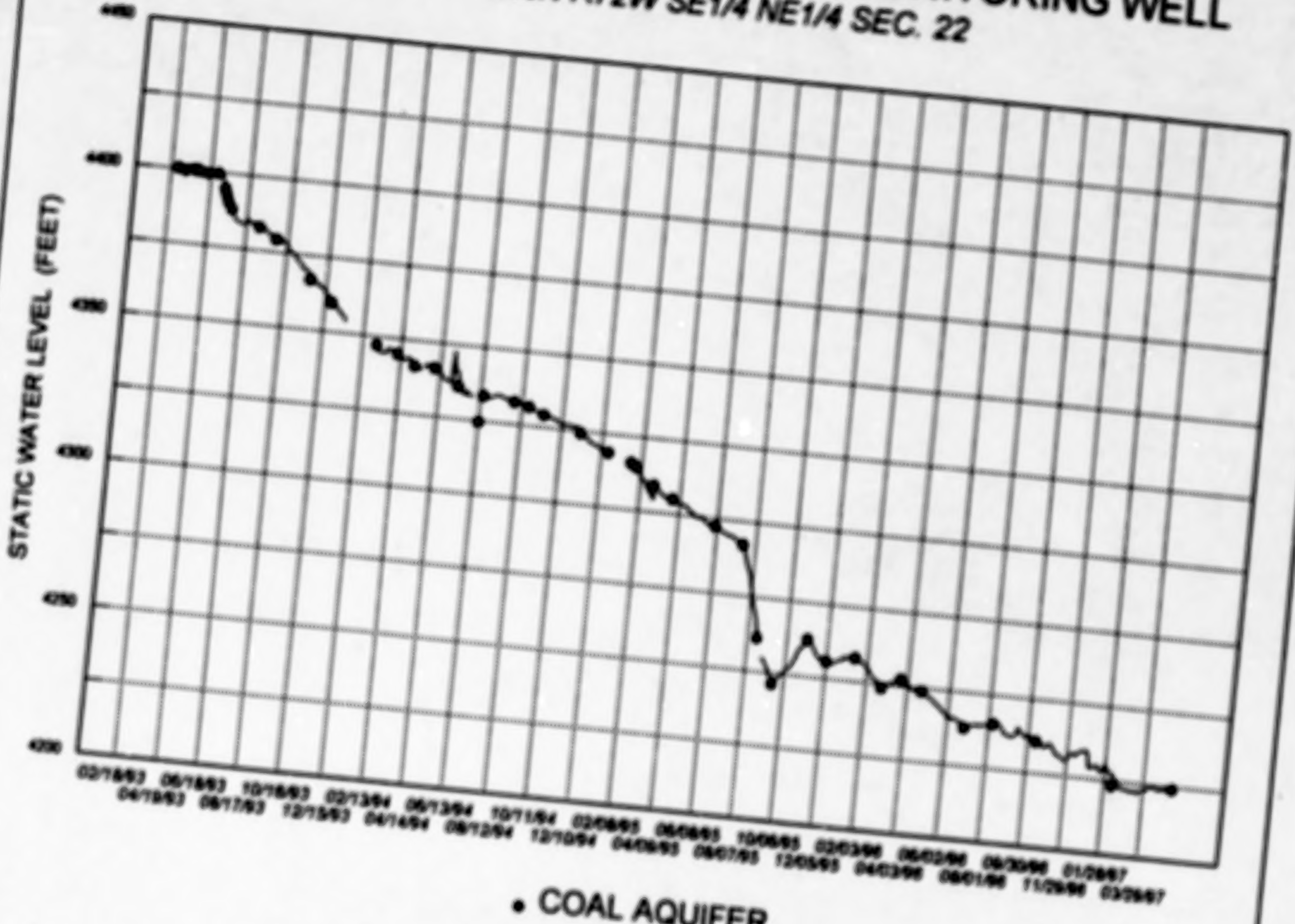
T47N R72W NW1/4 NW1/4 SEC. 2



ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

MARQUISS PROJECT - WATER MONITORING WELL

T48N R72W SE1/4 NE1/4 SEC. 22



ELEVATIONS FROM TOPO MAP - NOT SURVEY DATUM

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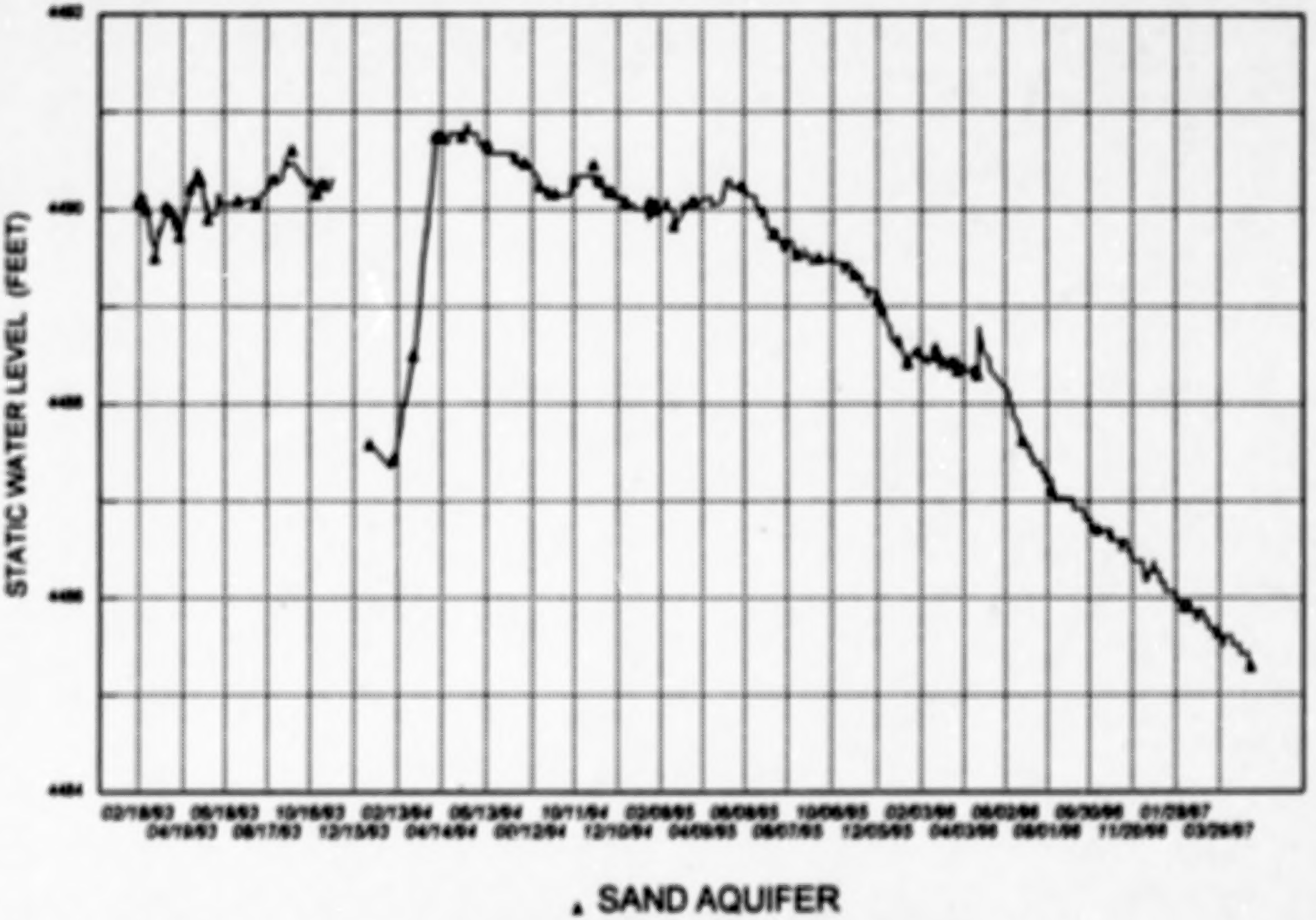
MARQUISS PROJECT - WATER MONITORING WELL

T48N R72W SE1/4 NE1/4 SEC. 22



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